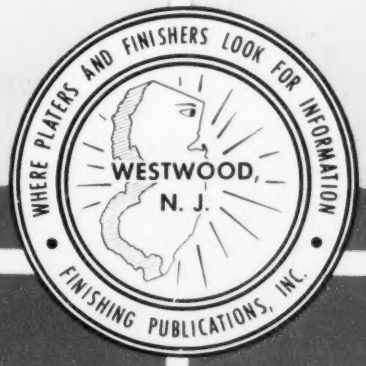
APRIL, 1956

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

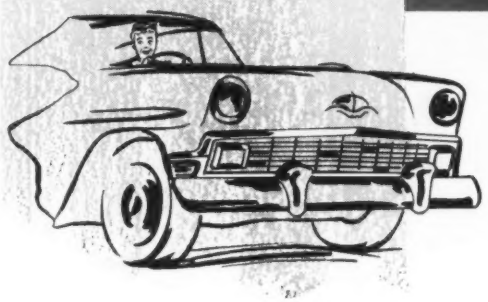
FOUNDED 1903



READ & PASS ON

LIBRARY OF CLEPO SERVICE

SAT-N-ETCH



...a treatment of interest to producers of aluminum articles

SAT-N-ETCH is actually a "finishing" process. Most other CLEPO products are formulations for cleaning, processing and protecting metal surfaces prior to or following certain production steps.

CLEPO SAT-N-ETCH produces a clean, silvery appearance on wrought or sheet aluminum. Many shops are now using this process to meet the sales department's demand.

This is a 2-step process, involving an etchant (CLEPO 30-R) in the first step. This formulation is fast and efficient and lasts a long time. It also eliminates maintenance problems due to scaling up of tank and coils. Step No. 2 involves the use of CLEPO 180-S which removes smut, develops the silvery appearance and passivates the surface. CLEPO 180-S is a free-flowing powder. It eliminates the hazards of acid treatment.

CLEPO offers not only this "finishing" process to those working with aluminum but also formulations for cleaning prior to anodizing and spot-welding, stripping of anodic film, deburring and burnishing and for other surface treating purposes. Our nearest Field Service man will be glad to discuss our entire service in connection with CLEPO Formulations for aluminum. He has back of him twenty-five years of service to your industry.

FREDERICK GUMM *Chemical Company Inc.*

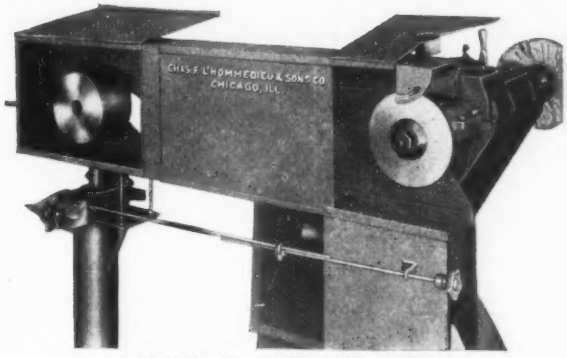
538 FOREST STREET, KEARNY, N.J.

Metal Finishing is published monthly by the Finishing Publications, Inc., 381 Broadway, Westwood, New Jersey, U.S.A.
Entered as second class matter at the Post Office in Westwood, N. J. Volume 54, No. 4, April, 1956. Four Dollars Per Year.

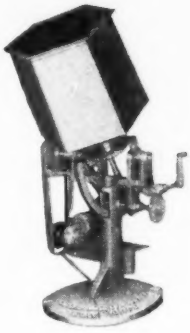
USE "RELIANCE" PRODUCTS FOR

ECONOMY : EFFICIENCY : DEPENDABILITY

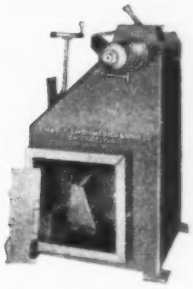
WRITE FOR FURTHER DETAILS



BACKSTAND IDLER WITH LATHE

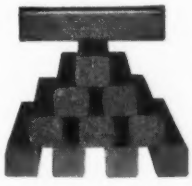


OBLIQUE
TUMBLING BARREL



#23A
POLISHING LATHE

BACKSTAND IDLER



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STANDARD SIZE
2 x 2 x 10"

NUWAY BUFFS FOR
FAST CUTTING

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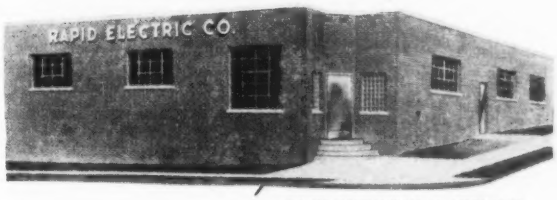
Our plant facilities have been enlarged....

INDUSTRIAL DIV.

INDUSTRIAL DIV.



MAIN BUILDING & OFFICES

. . . . in order to continue to serve YOU, the plating industry, with the highest quality d.c. rectifiers, at the lowest price and speediest delivery possible.

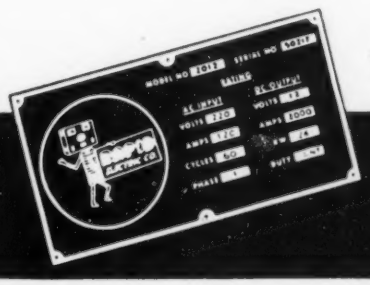
In line with our recent price reduction of germanium units, we are undertaking an expansion program, enlarging our staff, and acquiring additional space, so that we may best serve the needs of the industry.

We have recently allocated 50% additional plant area to the development and production of germanium rectifiers, and automatic controls.

Technical support, and an informative bulletin release program has been enacted to furnish assistance to our distributors, who directly serve the needs of the individual platers.

It is your continued confidence in our equipment that enables us to unceasingly strive to improve our product and continue to offer you the best in rectifiers and related equipment.

We shall continue to expend every effort towards this goal.



THE NAMEPLATE THAT MEANS *"More Power to You!"*

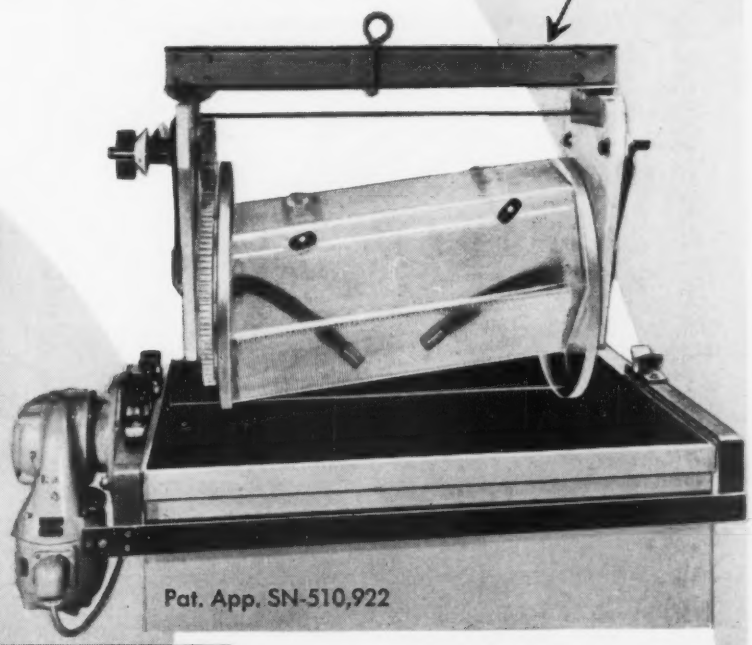
RAPID ELECTRIC COMPANY

2889 Middletown Road • New York 61, N. Y. • Phone: Talmadge 8-2200

BELKE DOUBLE OSCILLATION

Improves Plating Quality
Reduces Plating Time
Cuts Plating Cost

Eccentrically mounted cylinder oscillates as it rotates



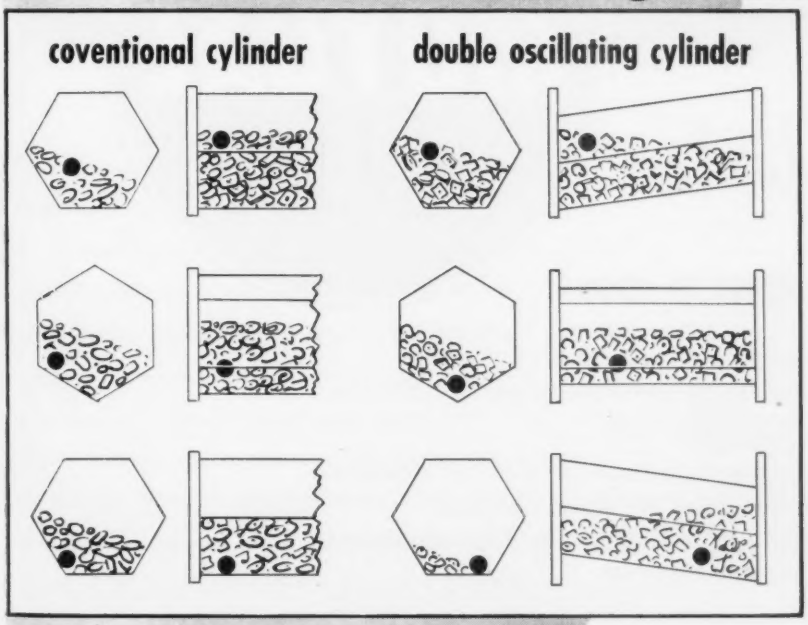
Pat. App. SN-510,922

Why!

Because the parts move up and down, back and forth, round and round. All faces are exposed. You get a specified thickness on all surfaces in less time.

See the difference

The diagrams below illustrate the difference in mixing action. The black spot represents a marked piece in the work.
Note how the black spot moves round and round in the conventional cylinder.
Then note how the black spot moves both around and across in the Double Oscillating Cylinder.



Mixes work the way a plating cylinder should

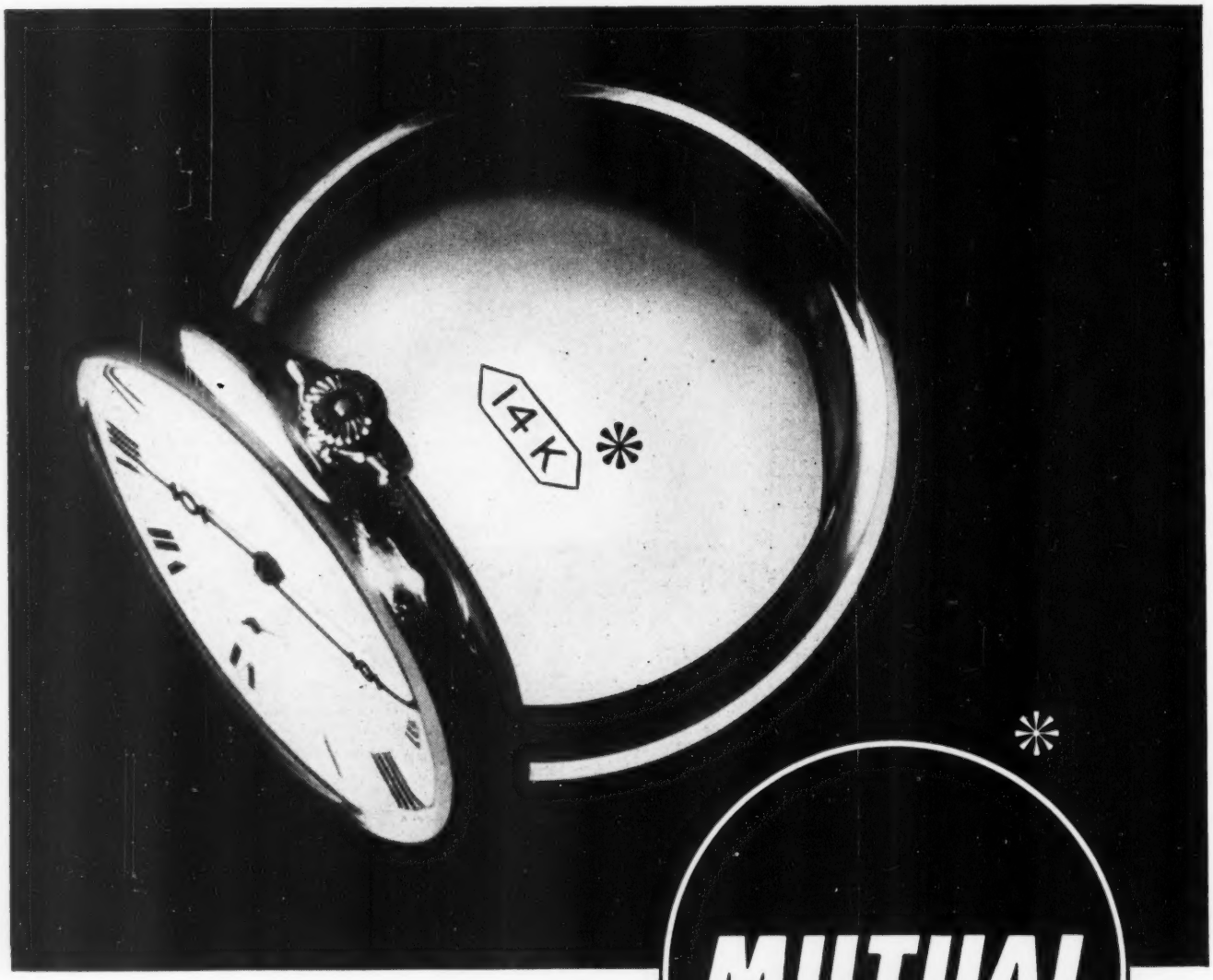
When you see this new multiple mixing action you'll agree it's the way a plating barrel should work and want no other kind.

Fortunately, all the new multiple mixing action comes from the cylinder. You can get wonderful improvement using the new cylinders with present equipment, but complete barrels designed throughout for double oscillation give even greater benefits.

See your BELKE Service Engineer or send for literature.

BELKE Double Oscillating Cylinders are available in all sizes from 14x30 regulars to 6x12 portables.
Order a double oscillating cylinder for your hard to plate jobs. See the great improvement in plating quality and big saving in plating time.

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51
EVERYTHING FOR PLATING PLANTS



MUTUAL

*"Symbols YOU CAN RELY ON"

CHEMICAL PROGRESS WEEK-APRIL 23-28

The karat number is the hallmark of quality on any article made of gold. In addition to signifying the guaranteed gold content, it is also a symbol of the reliability of the manufacturer.

The Mutual trademark on shipments of Chromium Chemicals is likewise a mark of quality and reliability. Mutual has always taken pride in its reputation for producing chemicals which meet rigid specifications and for supplying the needs of its customers.

Chromic Acid • Sodium Bichromate • Potassium Bichromate

MUTUAL CHEMICAL DIVISION

MUTUAL — ALLIED CHEMICAL & DYE CORPORATION

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Allied Chemical

top results are at hand

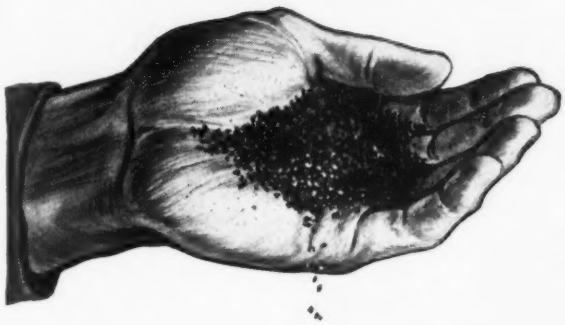
WITH

SIMONDS ABRASIVE CO.

Borolon

TRADE MARK

ABRASIVE GRAIN



POLISHING

TUMBLING

PRESSURE BLASTING

Hard, sharp and tough! Course, medium or fine! Whatever type of abrasive your jobs call for . . . Borolon, fused crystalline aluminum oxide, gives consistently high results. Thoroughly tested for uniformity, controlled shape, exact size. Made in Simonds electric furnace plant at Arvida, Canada, and processed by our Philadelphia plant into a full range of sizes for everything from course polishing to fine finishing. Write for free bulletins, ESA-198 on polishing grain, ESA-236 on tumbling abrasive and ESA-60-5 data sheet on Boroblast for pressure blasting.

CALL YOUR SIMONDS DISTRIBUTOR

LOCAL STOCK
FAST SERVICE

SIMONDS ABRASIVE COMPANY • PHILADELPHIA 37, PA.

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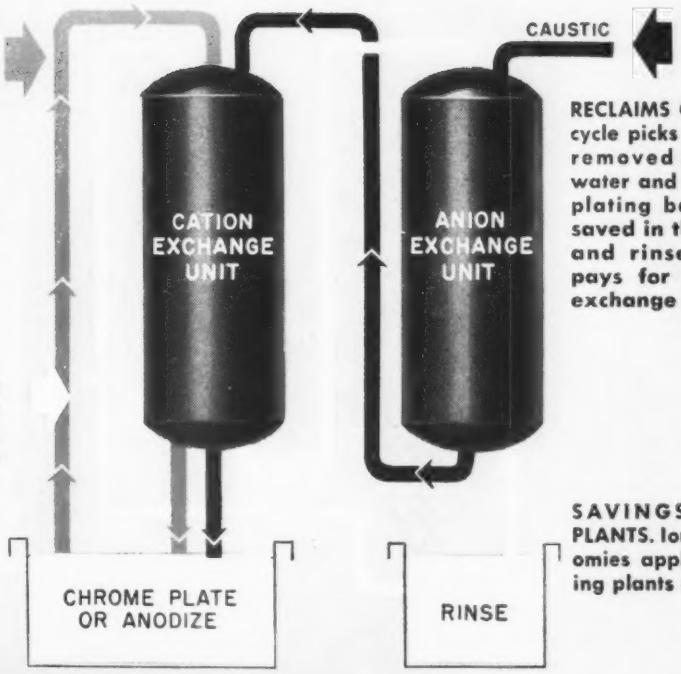
Division of Simonds Saw and Steel Co., Fitchburg, Mass.

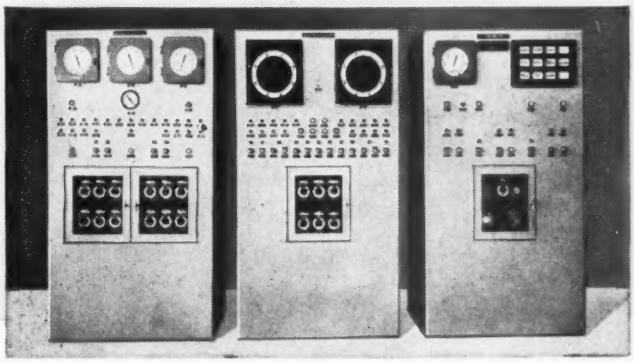
RENEWS PLATING BATH. This cycle removes aluminum, copper, iron and other impurities . . . allows continued re-use of bath . . . eliminates disposal problem. Compared with the usual toxic-waste disposal equipment, ion exchange saves up to 50% on initial costs, 75% on operating costs, 80% on floor space.

RENEWS RINSE WATER. Cation unit removes metallic impurities . . . anion unit removes chromic acid . . . allowing continued reuse of rinse water. Cuts consumption 90%!



RECLAIMS CHROMATE. This cycle picks up chromic acid removed from the rinse water and returns it to the plating bath. Chromate saved in the plating bath and rinse water often pays for the entire ion exchange installation!

SAVINGS FOR SMALL PLANTS. Ion exchange economies apply to small plating plants as well as large.



AUTOMATIC CONTROLS for ion exchangers in an auto parts plating plant. These controls simplify operation. No specially trained operators or technicians required.

Ion Exchange Cuts Plating Costs

Modern ion exchange equipment really pays off for plating plants. Here's why:

Faster production. Dip periods are shorter, and there's no down-time for dumping because baths are always at full strength. Time savings are biggest for bright-dipping, anodizing, etching, stripping.

Better quality. Clean baths produce more uniform plating deposits. Clean rinses prevent water stains and spots.

Lower operating costs. Contaminant-free baths use less current. The improved quality means fewer rejects . . . and reduced polishing and wiping costs.

A large aircraft manufacturer saved $10,000 on anodizing in the first year with ion exchange. A leading auto maker prevented a stream pollution shut-down, improved quality, reduced costs . . . and uses the same ion exchange equipment for treating other process water in the plant!

Largest manufacturer of ion exchange equipment, The Permutit Company, is the only firm that offers a complete ion exchange service: rinse water or bath analysis, engineering, equipment, ion exchange resins and automatic controls . . . *all from one source.*

For details, write: The Permutit Company, Dept. MF-4 330 West 42nd St., New York 36, N. Y.

PERMUTIT®

rhymes with "compute it"

ION EXCHANGE for Water Conditioning
Chemical Processing • Industrial Waste Treatment

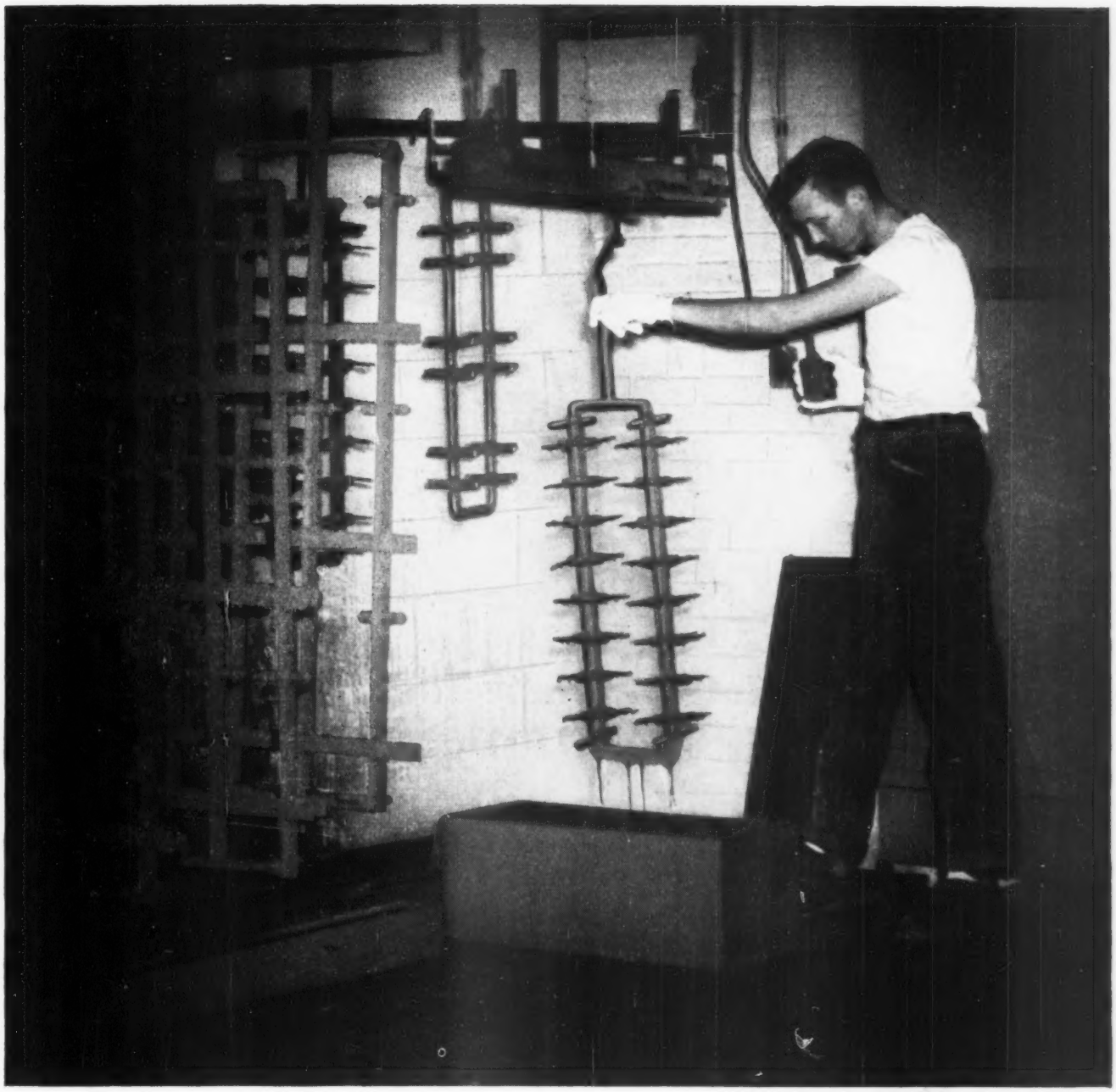


Photo courtesy F. D. Pace Co., Grand Rapids, Mich.

What coating's on top?

Unichrome Coating 218X, of course!

EXCEPTIONAL service life makes Unichrome Coating 218X the preferred rack coating in an impressive number of plants. Applied on top of unequaled Unichrome Primer 219PX, this flexible, vinyl plastisol coating withstands all plating and cleaning cycles . . . doesn't chip, crack, blister . . . rinses freely. It won't contaminate solutions . . . is approved for use in leading bright nickels. Saving time and maintenance, users find it costs least in the end.

If you don't want to apply Coating 218X yourself, nearby qualified specialists can do it for you. Ask us for names.

PLATING MATERIALS
ORGANIC COATINGS
ZINC & TIN CHEMICALS
CERAMIC MATERIALS
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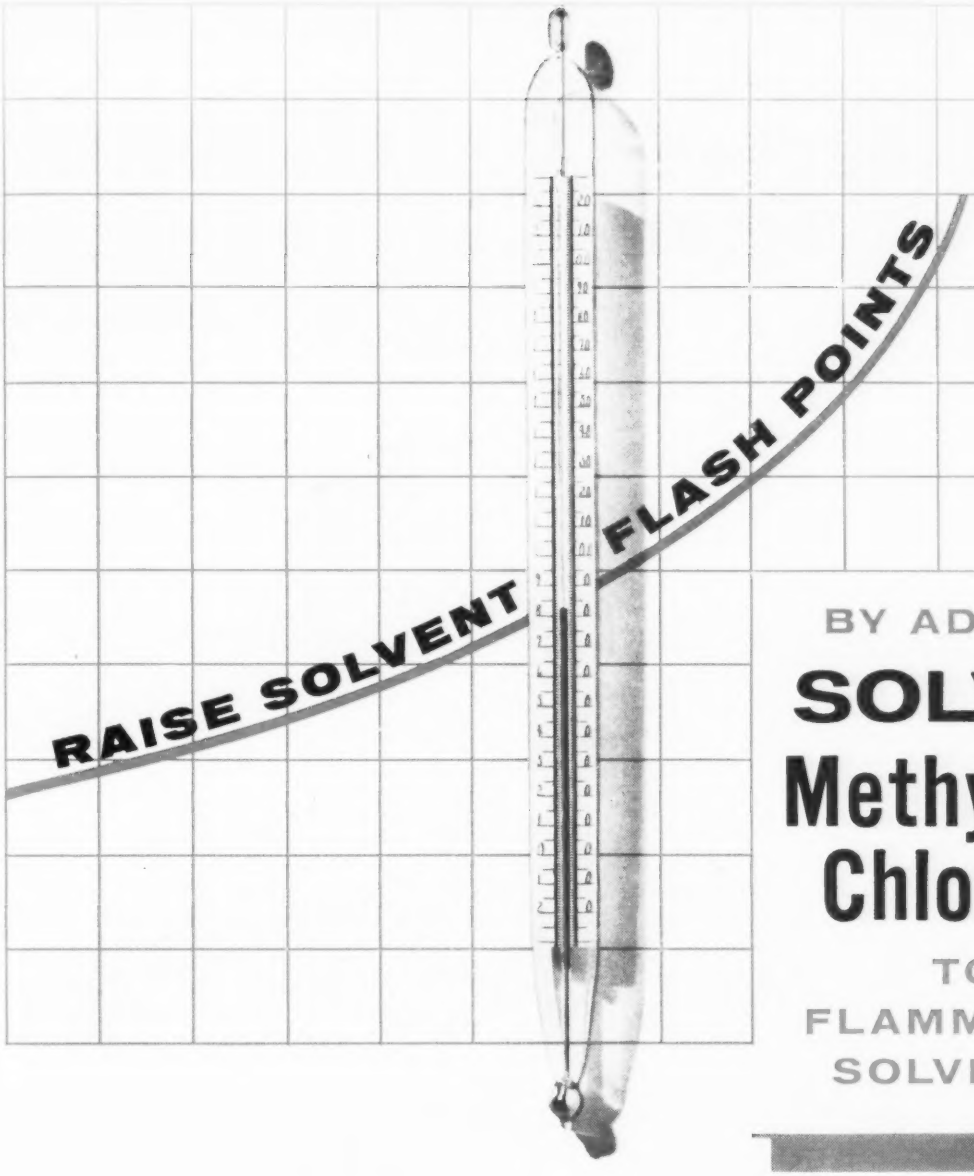

RAISE SOLVENT FLASH POINTS

BY ADDING

SOLVAY Methylene Chloride

TO FLAMMABLE SOLVENTS

SOLVAY® Methylene Chloride is an economical, nonflammable solvent with low toxicity that can be used to raise the flash points of many solvents into the safety zone.

The addition of SOLVAY Methylene Chloride to many aliphatics, aromatics, alcohols, ketones, esters and other solvents having flash points below 80° C. will produce mixtures that will meet I.C.C. standards for nonflammability.

Write for helpful article "Methylene Chloride for Raising Solvent Flash Points . . . and Its Effect in 27 Solvents," a reprint from "Petroleum Processing," Nov., 1955.

SOLVAY PROCESS DIVISION
ALLIED CHEMICAL & DYE CORPORATION
61 Broadway, New York 6, N. Y.

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Soda Ash • Snowflake® Crystals • Chlorine
Potassium Carbonate • Calcium Chloride
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Cleaning Compounds • Methylene Chloride • Monochlorobenzene
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61 Broadway, New York 6, N. Y.

Allied Chemical

Gentlemen: Please send me—AT NO COST OR OBLIGATION:

- ☐ Reprint—"Methylene Chloride for Raising Solvent Flash Points."
- ☐ Your new book on Methylene Chloride and other SOLVAY Chloromethanes.
- ☐ Additional information—see attached letter.

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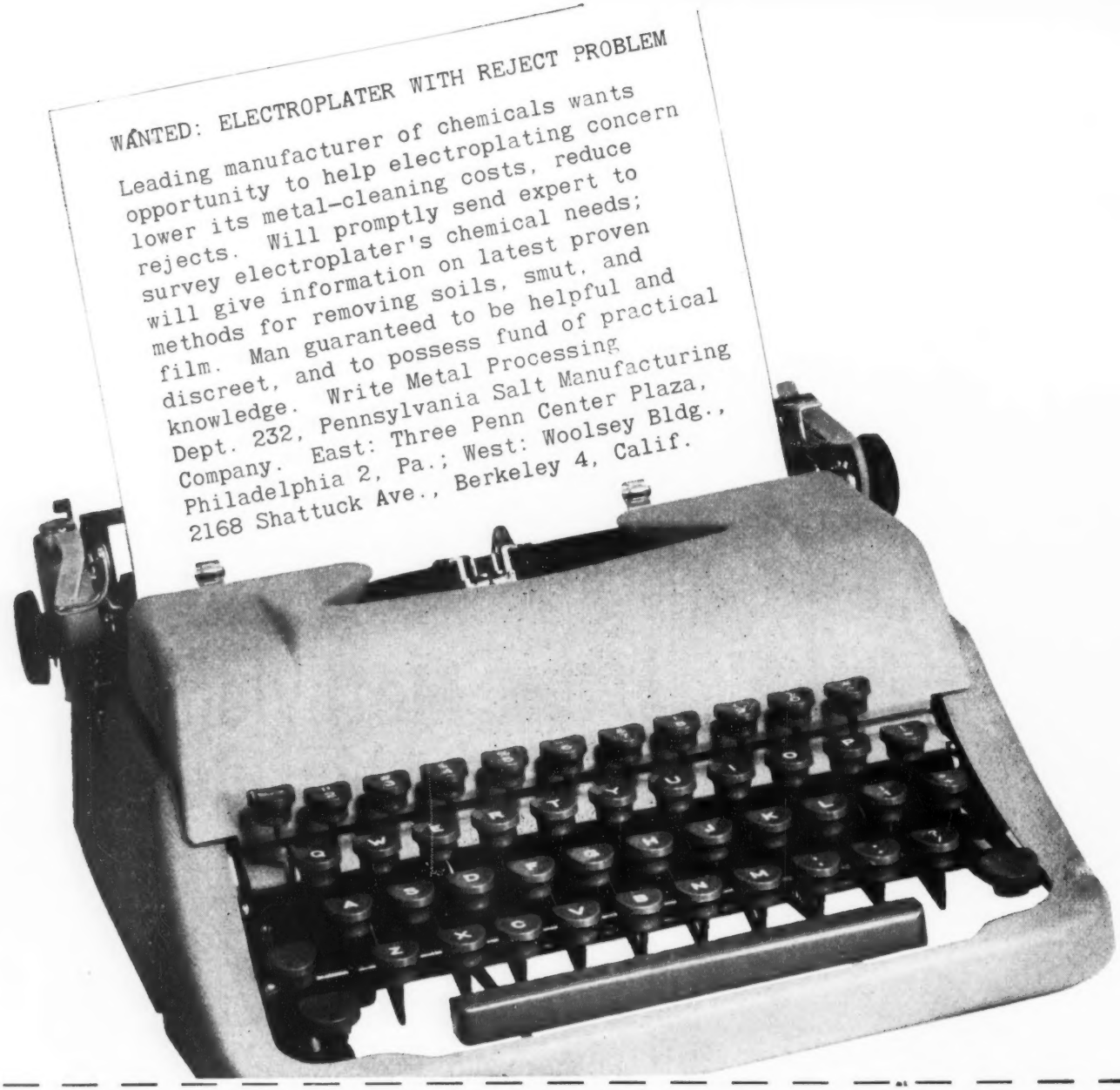
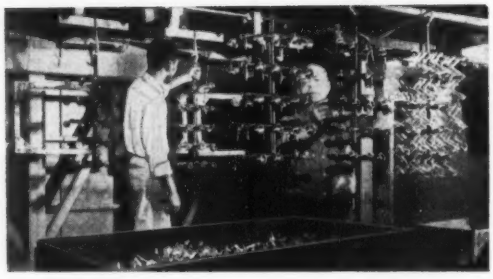




"It paid us to get advice from Pennsalt," says George Long, President of Aetna Electroplating, Philadelphia.

"By talking *results, properties, costs* of chemical cleaners with our Pennsalt specialist, we were able to reduce rejects from our new Udylite automatic plating machine to practically nothing. We now turn out 165 racks of quality work per hour—using less chemicals to do more work!"

Chemical Progress Week April 23-28

Pennsalt Chemicals

Metal Cleaners • Phosphate Coatings • Cold-Working Lubricants

IN CANADA: PENNSALT CHEMICALS OF CANADA, HAMILTON, ONTARIO

A BETTER START FOR YOUR FINISH

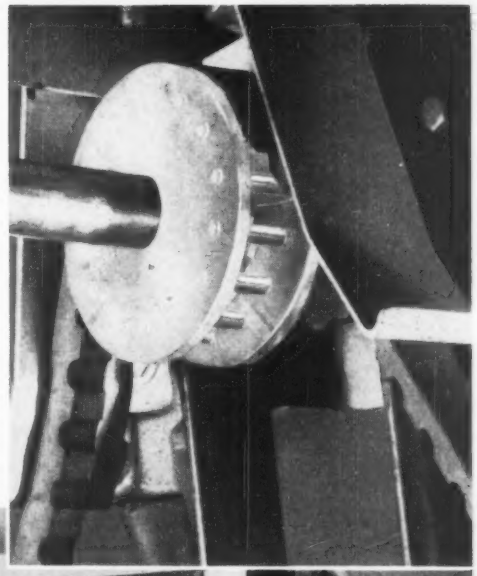
New . . . Exclusive . . .

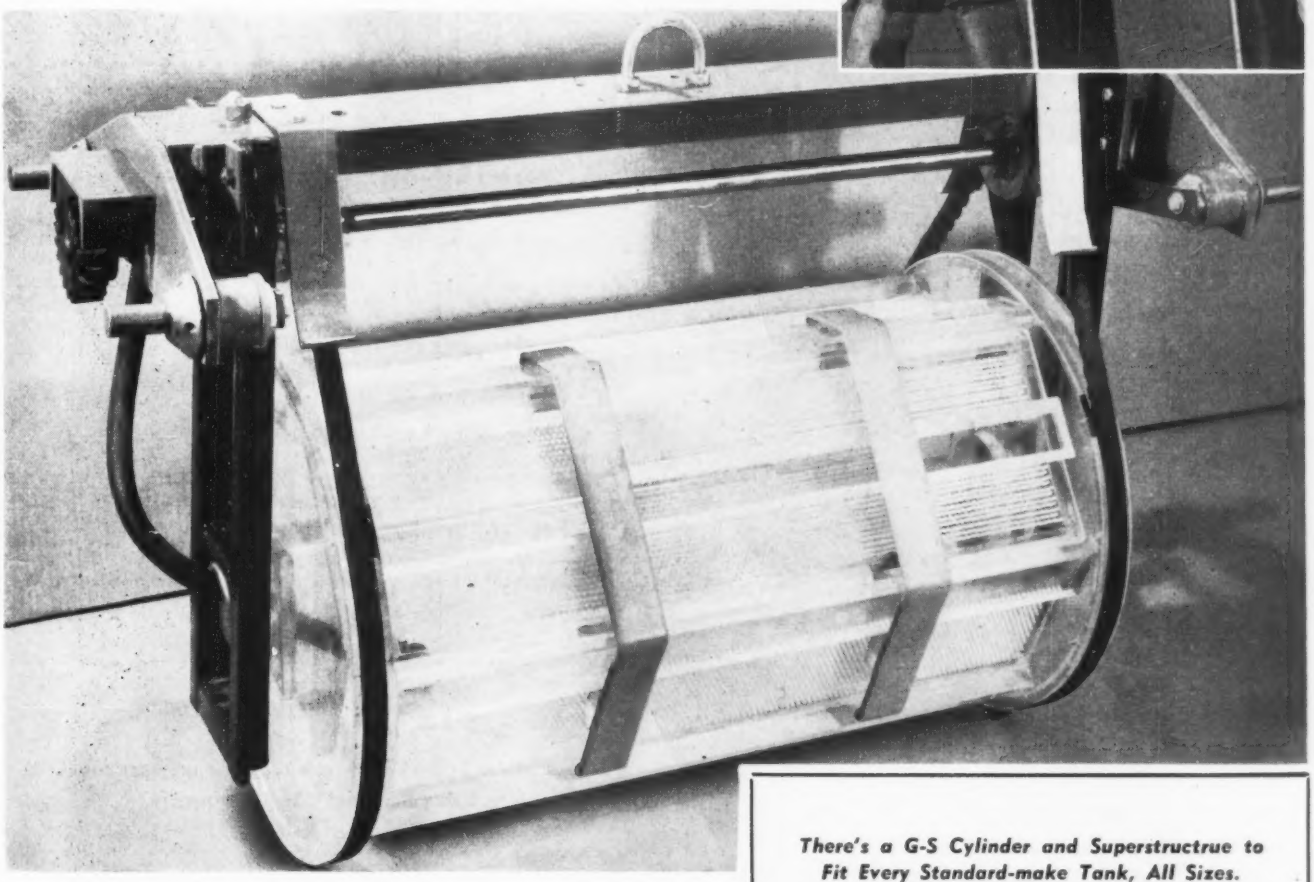
"COGGED-V-BELT"

The BELT-DRIVE with the GEAR-GRIP

Eliminates: Cylinder-End Drive Gear, Idler Gear, Pinion Gear, Bearings

U. S. Pat. 2,562,084. Other Pats. Applied For.





Cuts Costly Gear Maintenance 100%

Another Gill-Singleton exclusive! **Here's *your first* and *only* plating barrel with a belt-drive that doesn't depend on friction-grip alone. G-S "Cogged-V-Belts" mesh with matching cogs in H-T Sincolite Drive Pulleys — can't slip, creep or vary speed. V-belts are molded Neoprene over woven steel tensile members for greater strength. Won't stretch. Belts resist acids, alkalies, floating oil or grease. For all loads — light or heavy — under all conditions. Deliver constant, mechanical-type grip *without gears*. No more gears in solution. No more gear maintenance or replacement.**

Other exclusive features: "Locking U-Hubs" — danglers angled down through hubs won't ride up on load. Quick, easy changing of cylinder and danglers saves hours. Adjustable Bearings, Floating End Plates for constant contact — cylinder can't "rock" in saddles. Total cylinder immersion prevents explosions. No solution contaminants on the equipment. Cylinders of H-T Sincolite or Tempron (hard rubber) fusion-welded, heavy-ribbed construction. See more features than ever before offered.

There's a G-S Cylinder and Superstructrue to Fit Every Standard-make Tank, All Sizes.

(top inset) Close-up of "Cogged-V-Belt" Drive. (left) Gill-Singleton GSU 14 x 30 cylinder and superstructure for competitive tank.

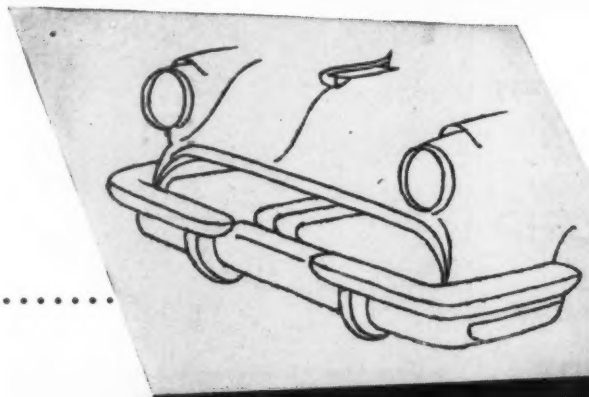
Cylinders: H-T Sincolite or Tempron (rubber). **G-S makes both, to fit any standard make superstructure, any size. Send details with your inquiry.**

Send for Bulletin GSB 101 and Price List.

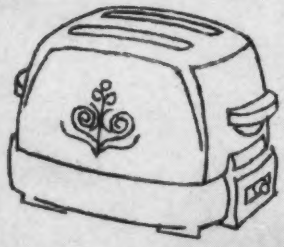
The G. S. Equipment Co.

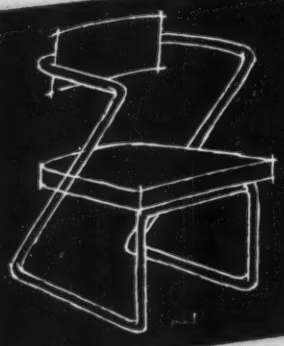
5317 St. Clair Ave., Cleveland 3, O.

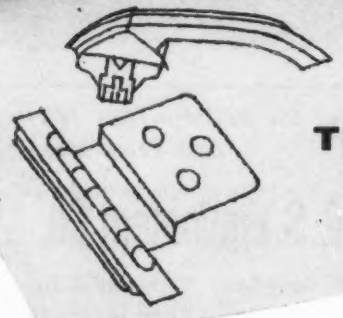
ENdicott 1-0167



HARSHAW electroplating CHEMICALS and ANODES







nickel plating

... still and barrel ... nickel anodes—all commercial grades and sizes ... anode bags ... single nickel salts—nickel chloride ... nickel carbonate ... nickel fluoborate ... boric acid.

chromium plating

... pure "Krome Flake" 99.8% CrO_3 ... sulphates less than .10% ... lead, tin-lead and antimony-lead anodes.

copper plating

... copper ball anodes ... Rochelle Salts ... sodium and copper cyanides ... copper sulfate ... copper fluoborate.

cadmium plating

... ball and cast cadmium anodes ... cadmium oxide ... sodium cyanide ... cadmium fluoborate.

tin plating

... cast tin anodes ... sodium stannate ... stannous sulfate ... tin fluoborate ... acid tin addition agent.

zinc plating

... ball and cast zinc anodes ... sodium and zinc cyanide ... zinc sulfate ... zinc fluoborate.

lead plating

... cast lead anodes ... lead fluoborate.

silver plating

... silver cyanide.

THE HARSHAW CHEMICAL COMPANY

Cleveland 6, Ohio

Chicago 10, Ill. • Cincinnati 13, Ohio • Detroit 28, Mich.
Houston 11, Texas • Los Angeles 22, Calif. • Philadelphia 48, Pa.
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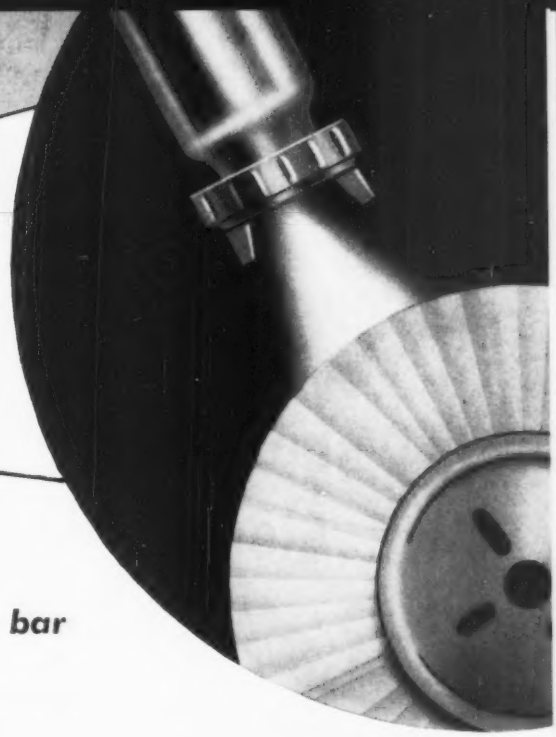
STUTZ

LIQUISPRAY



BUFFING COMPOUND

Here's why "LIQUISPRAY" saves you money over bar compounds

- No crumbling or nubbins — all the compound goes on the wheel
- Same regulated quantity applied
- No machine downtime to change bars

Here's what "LIQUISPRAY" can mean to you

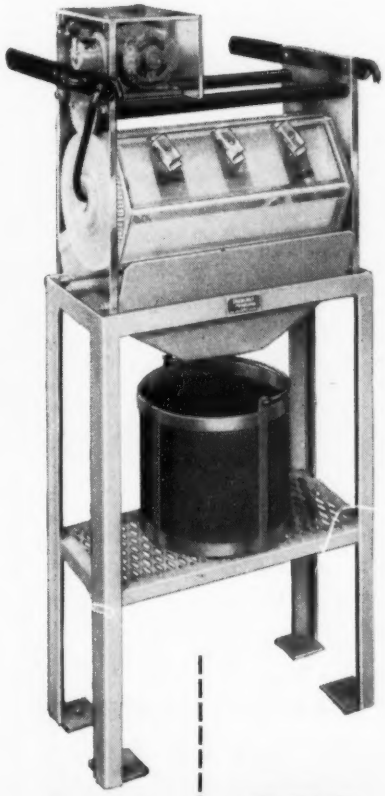
- Increase operator efficiency
- Compound costs cut up to 50%
- More uniform finish and fewer rejects
- Tremendous increase in buff life

Here's why you should use "LIQUISPRAY"

- Abrasives will not settle
- No clogging of idle guns
- No fire hazard
- All the compound sticks to the wheel
- Leaves work free of dirt and easy to clean prior to plating

Choice of heavy cut, cut and color, or color in either tripoli or stainless steel grades.

We invite your inquiry specifying your particular requirements. Trial samples available.



STUTZ

Portable Plating Barrels

★ The Stutz Portable Barrel is made in 2 standard sizes with cylinders having inside dimensions of 6" x 12" and 8" x 18", I. D., and smaller upon application. Standard openings are 3/32". Smaller or larger openings can be furnished as required.

★ Baskets in perforated metals or wire mesh.

★ Load/Unload Stand for convenient and fast handling of work load.

MADE IN TWO STANDARD SIZES

Standard Openings	3/32"
6" x 12" I. D.	$186.50
8" x 18" I. D.	$295.00
Stand	$ 39.50
Perforated metal	$ 9.15
Wire mesh	$ 6.15

Write for Our New Catalog . . .

"Complete metal finishing equipment & supplies"

Serving Industry 35 Years

GEO. A. STUTZ MANUFACTURING CO.

4430 CARROLL AVE. **CHICAGO 24, ILL.**

102 Hands
To Help You Find the Answers to Electroplating Problems

Members of the Du Pont customer service team are strategically located near plating centers to bring you prompt help on any immediate electroplating problem.

When trouble breaks, one of these specialists is only a phone call away. He is equipped to handle specific problems ranging from improperly operating baths to unsatisfactory deposits of metal. He'll suggest correct bath compositions, plating times and cleaning methods to assure you of best plating results. Recommendations are compiled and presented in a special, confidential report for your use.

If you need help to find the answer to your plating problems, give our customer service man a call at the Du Pont office nearest you.

DISTRICT AND SALES OFFICES

Baltimore ..... PLaza 2-2862	Charlotte ..... FRanklin 5-5561	Cleveland ..... CHerry 1-6078	New York ..... LOngacre 3-6440
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DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

ELECTROCHEMICALS DEPARTMENT
E. I. DU PONT DE NEMOURS & CO. (INC.)
WILMINGTON 98, DELAWARE

NEW SHAPED, EXTRUDED APW SILVER ANODES

"RECTANGULAR"

"DOG BONE"

"TEAR DROP"

STANDARD SHAPES

*Pat. Pending

CONTROLLED GRAIN SIZE: APW EXTRUSION PROCESS* controls grain size within definite limits—minimizes sheddings

The new APW Extruded, Shaped Anodes provide two very definite and important advantages:

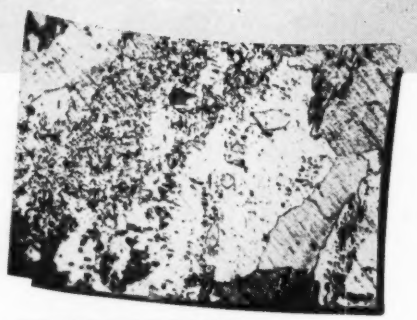
Through controlled grain size, they virtually eliminate shedding and all of its costly results in electroplating.

Their scientifically determined "shapes" prolong considerably the useful life of the anode—with appreciable savings in costs.

The small and uniform grain size produced in the new APW Extruded Anodes is controlled between definite ideal limits. Corrosion is smooth and uniform for consistently smooth electrodeposits. Rejects are a comparative rarity!

The distribution of mass material in the scientifically designed shapes help to maintain a more efficient ratio between anode weight and active surface area. After 85% by weight has been plated off, this APW Anode retains 80% of its original active surface area. You profit with the longer useful life of the anode . . . polarization is minimized . . . there is less silver scrap to be refined.

To be certain the silver you buy in anodes is used most efficiently, APW will develop special anode shapes to meet particular plating bath conditions. We would be pleased to have you consult us on any anode problems you may have.



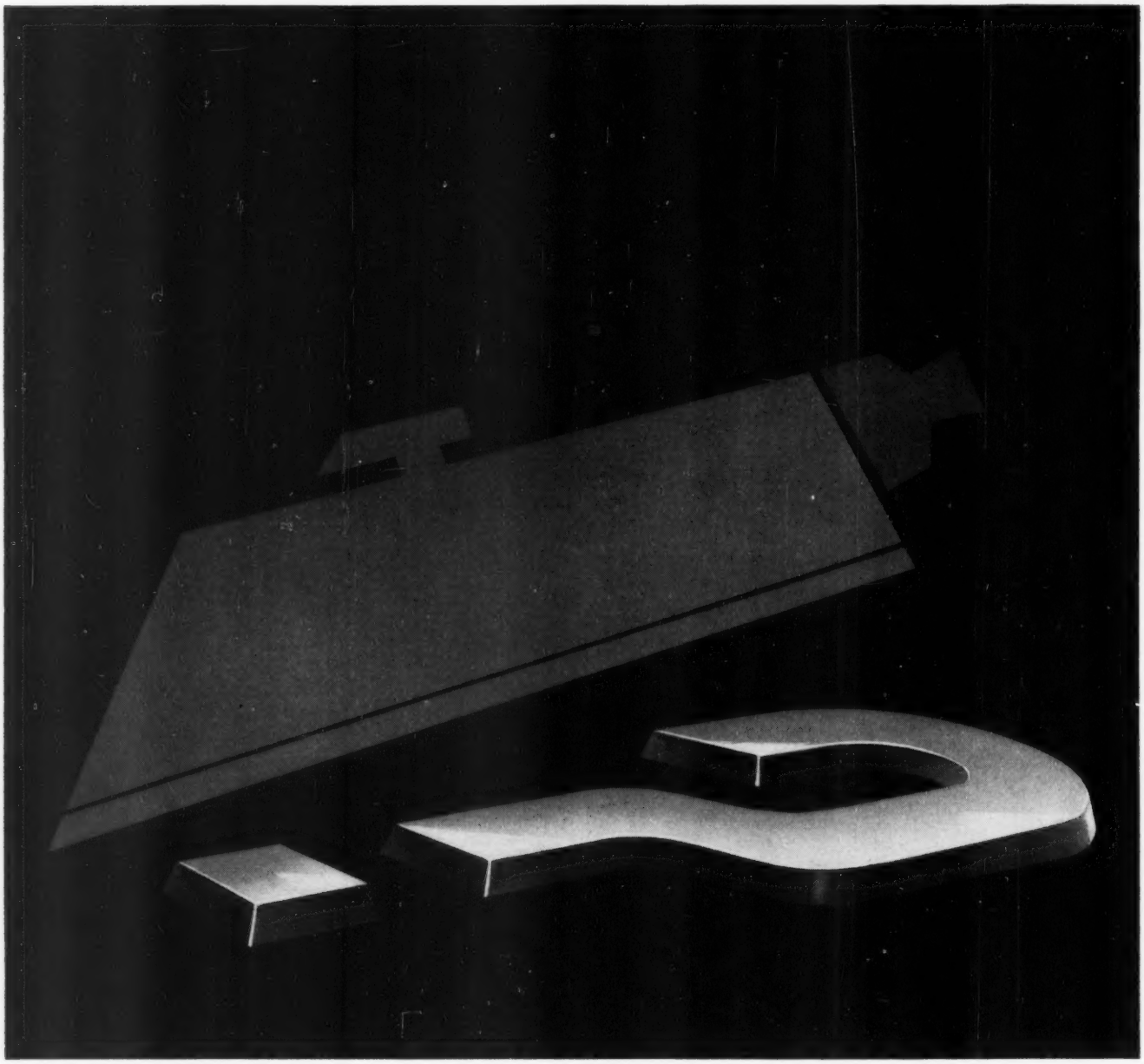
ROLLED FLAT PLATE ANODE SECTION:
This Photomicrograph shows highly irregular, uncontrolled grain size—a major cause of shedding and resultant rough electrodeposits.

APW EXTRUDED ANODE SECTION:
Note small, fully controlled regularity of grain size that promotes uniform corrosion, smoothest electrodeposits, less rejects.

THE AMERICAN PLATINUM WORKS

APW

231 NEW JERSEY RAILROAD AVENUE • NEWARK 5, NEW JERSEY



Iron out your chrome-plating problems with Diamond

Let DIAMOND's technical specialists go to work on your chrome-plating problems. These men work full time on customers' questions. They come up with complete, profit-making answers. Their service is free.

In producing chromic acid, DIAMOND controls *every* processing step to safeguard quality. DIAMOND experience starts with importing the chrome ore and making the soda ash, and extends through production and delivery. It even includes standing by your side, if you wish, to help you get top-quality plating results and keep costs low.

DIAMOND facilities—two chromic acid plants and nine warehouses and sales offices across the country—assure you uninterrupted supply and dependable service. DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND ALKALI CHEMICALS

Diamond Chromic Acid

LOWER YOUR COSTS IN PLATING

THE FINISHING TOUCH

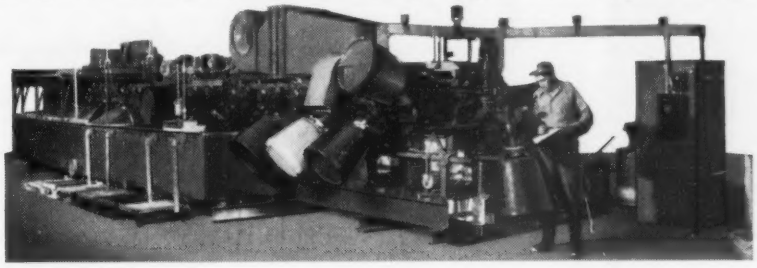
by Guy A. Cummings
Metal Finishing Sales Manager
FREDERIC B. STEVENS, INC.

How Modern Equipment Can Improve Your Operations

Judging from the vast number of quotations on automatic equipment for electroplating, anodizing and processing being made each month at Stevens, we know the interest in automatic equipment has never been higher. To meet competitive prices, improve finishes and lower labor costs, metal finishers are constantly challenged to make modern improvements in their operations. Usually this means more modern equipment.

Let us tell you how the Stevens Automatic Barrel Plating Machines can help you. They are used for zinc, cadmium, nickel, brass plating of such small parts as screws, bolts, nuts and stampings, and also a wide variety of bulk immersion processes such as phosphatizing, washing, pickling, and chromating.

We have been making these machines for a long long time—hundreds are in operation—so you can be confident that there are no mechanical bugs. They are simple to operate—feature automatic unloading—and when equipped with automatic load devices, several machines can be operated by only one man. The cylinders which take the parts to be plated are the oblique open ended type—without



covers. By raising or lowering the cylinder the parts slide in and out without the necessity of unclamping and removing covers normally needed for horizontal type cylinders.

The Stevens simple compact design makes it economically feasible to purchase production capacities as high as 4000 pounds per hour in one machine, or just as practical to distribute the capacity between two or more machines to provide flexibility in plating thickness, production, etc.

Here are other advantages in using Stevens Automatic Barrel Machines—uniformity of deposit, fewer rejects, better working conditions, easier chemical control, better scheduling and delivery and *lower costs per piece.*

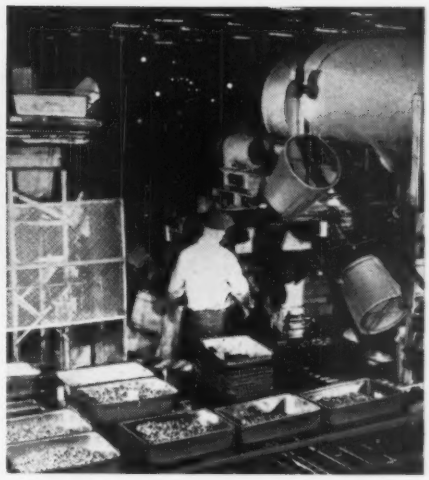
The selection of the right equipment, the capital investment required, the arrangement of your plant to install the equipment are important considerations. Frederic B. Stevens, Inc., with its long experience in the metal finishing field has made many analyses of this kind. We can help you too.

Write to Frederic B. Stevens, Inc., 1808 18th Street, Detroit 16, Michigan.

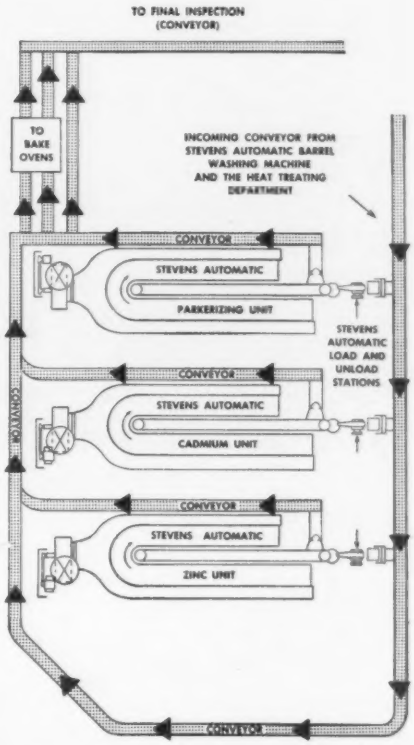
FREDERIC B. STEVENS INCORPORATED
YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN

METAL FINISHING EQUIPMENT AND SUPPLIES FROM CASTINGS OR STAMPINGS TO FINISHED PRODUCT

BRANCHES:
Buffalo • Cleveland • Indianapolis • New Haven



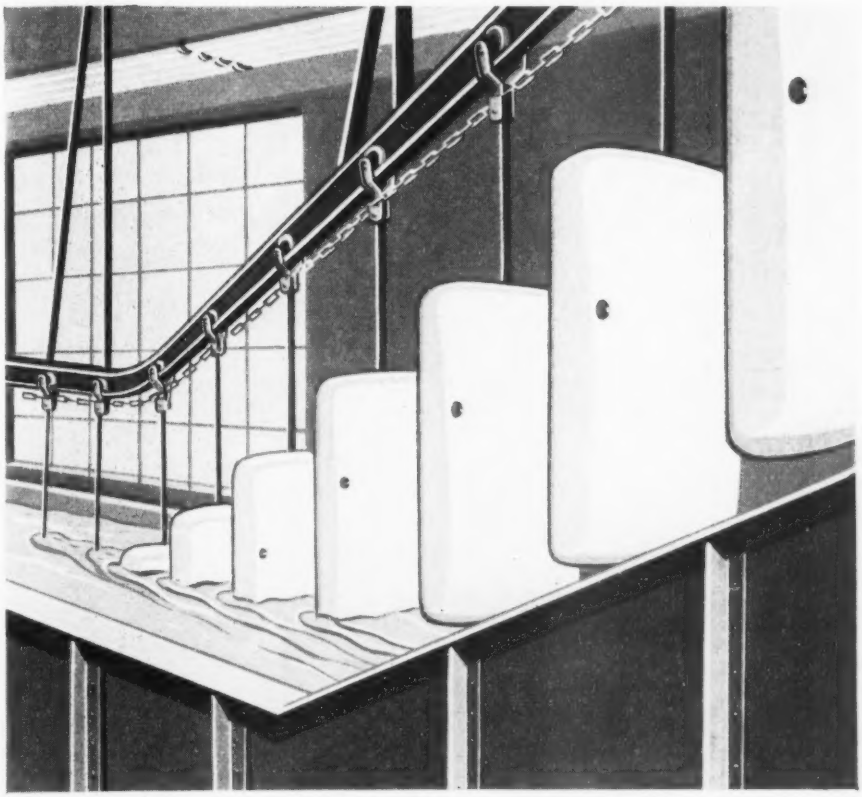
Showing Automatic Loading Device and Automatic Barrel Unloading Station on Stevens Automatic Barrel Processing Machine, incorporated as part of the Straight-Flow operation.



Millions of small stamped fastening devices, pre-assembled screws and nuts, and twisted-tooth lockwashers are automatically washed, parkerized, zinc and cadmium plated in Stevens Automatic Barrel Processing Equipment annually at this modern plant. Cleaner operation, fewer rejects and better control of plating thickness are some of the advantages being realized by the operators.

Dow . . . industry's most complete line of chlorinated solvents

DOW



Refrigerator cabinet rejects are briefly dipped in a stripping formulation based on METHYLENE CHLORIDE for thorough removal of alkyd and epoxy resin finishes before reprocessing.

No finish too tough for . . .
DOW METHYLENE CHLORIDE

You can strip the toughest finishes and protective coatings much more economically now. Solvent formulations based on DOW METHYLENE CHLORIDE handle in minutes jobs that normally run hours in other cleaning compounds. METHYLENE CHLORIDE *cuts* through faster, starts an even lifting action over greater areas of the part.

You're safer with METHYLENE CHLORIDE, too. It's *nonflammable*, and carries a *low toxicity* rating. METHYLENE CHLORIDE is one of the most effective flash and fire point depressants for use in mixtures with flammable solvents for cold cleaning applications. This versatile solvent is also receiving increased attention for use as a vapor-degreasing medium, particularly where the higher temperatures of other vapor-degreasing agents are objectionable or where the high-solvency power of METHYLENE CHLORIDE may be utilized.

Your Dow distributor can offer you unmatched service because he supplies the most complete line of chlorinated solvents . . . in addition to METHYLENE CHLORIDE, you might profitably use DOW PERCHLOROETHYLENE, DOW TRICHLOROETHYLENE, or the talk of the industry, CHLOROTHENE*. For an immediate mailing of technical and use information on any or all of these superior solvents, just return coupon to THE DOW CHEMICAL COMPANY, Midland, Michigan.

*Trademark

send for it now

THE DOW CHEMICAL COMPANY, Dept. S-943C, Midland, Michigan

Send me information on_____ My particular interest is stripping or cleaning_____

Name_____ Title_____

Company_____ Address_____

City_____ Zone_____ State_____

you can depend on DOW SOLVENTS DOW

At Last! a Germanium protected

It has always been the policy of Wagner Brothers to keep its "guinea pigs" in the laboratory until research and product development had perfected a product for which no excuses need be made.

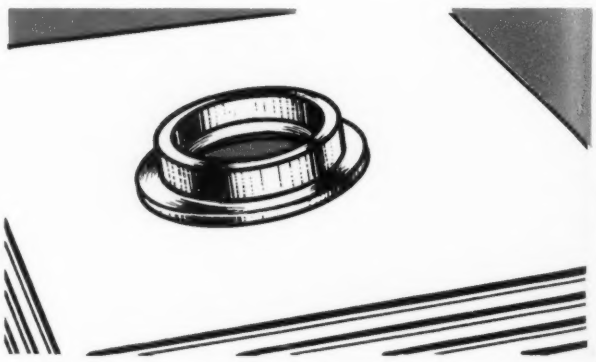
Now, after two years of experimentation and design in close collaboration with the General Electric Company, Wagner Brothers is proud to reveal the most advanced mechanism for germanium power rectification available anywhere.

EXCEPTIONAL EFFICIENCY

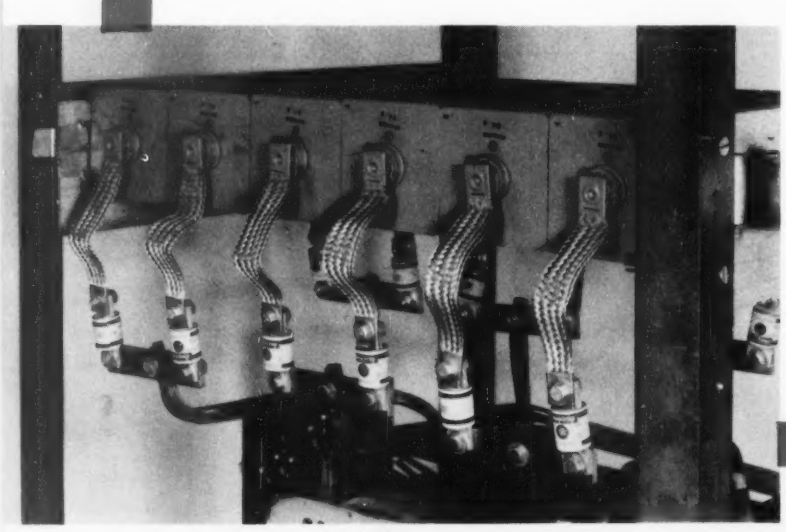
Designed specifically with the needs of the metal finishing industry in mind, the Wagner Brothers Germanium Rectifier offers you a vastly increased efficiency of operation and improved voltage regulation which is made possible by use of the germanium junction . . . *efficiencies as high as 95%, depending upon voltage and current.* And, conservatively rated Wagner Brothers' units will operate at up to 150% of rated current, without destructive effects to junctions. Voltage range from 6 to 48 volts, with current output up to 50,000 amperes, accommodates most metal finishing needs.

PROTECTED GERMANIUM CELLS

An efficient, hermetically sealed "Safety Cell" protects the germanium wafer from moisture and corrosive fumes of plating atmospheres. Basic stacks consist of six germanium cells, each with cooling fins. Every germanium cell is individually protected against circuit fault conditions and sudden overloads by easily replaced, fast-acting "amp trap" fuses.



The "amp traps" break circuit in 1/3 cycle, before damage can be done to the temperature sensitive germanium junction. All stacks are of a standard design and are interchangeable, either singly or in groups. The stack of six cells is rated at approximately 500 amperes.



COOLING SYSTEM

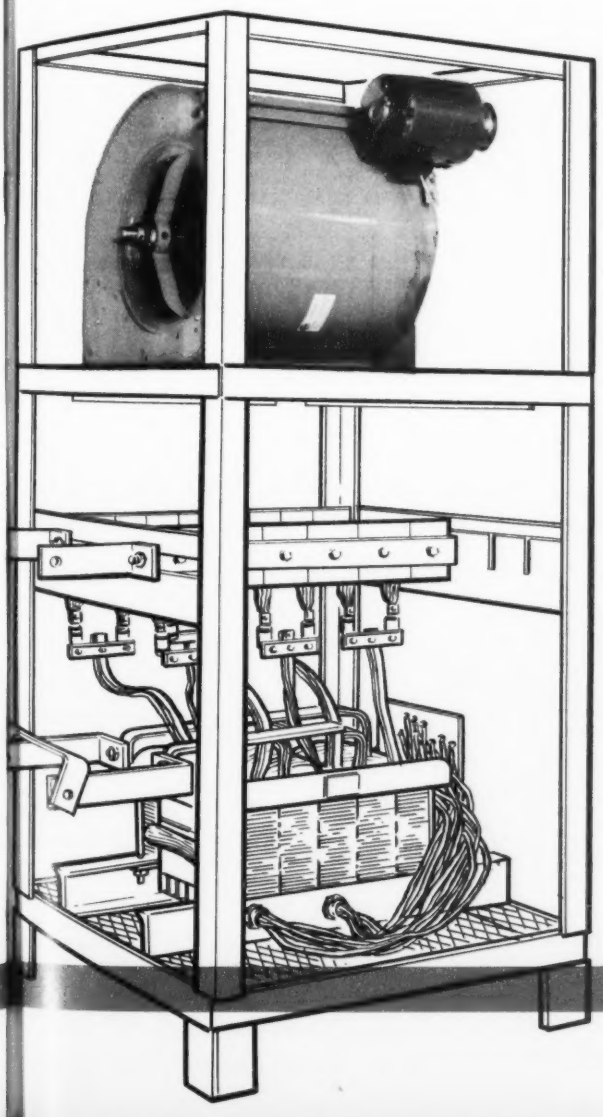
The Wagner Brothers Germanium Rectifying units are forced air cooled by an extra capacity centrifugal blower which expels warm air at the base of the cabinet. Germanium stacks are further protected from destructive temperatures due to blower failure by a pressure switch which, when the blower is inoperative, breaks input current. The blower is driven by a 3-phase motor, equipped with a separate con-

rectifier with 100% efficiency!

tactor as protection from thermal overloads. Bearings require no lubrication. An air filter screens out deteriorating particles of dusty atmospheres.

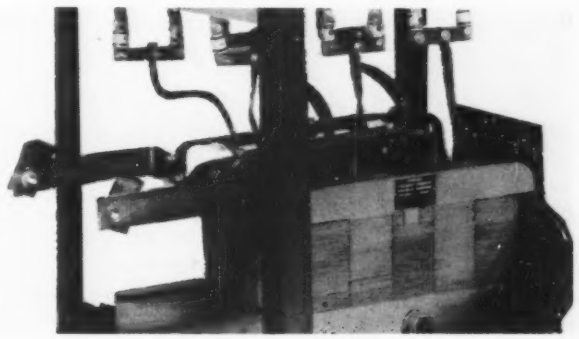
ELECTRICAL PROTECTION

In addition to individually-fused germanium cells, the Wagner Brothers Germanium Rectifier is protected against single phasing on the 3-phase circuit. The main contactor is provided with a thermal breaker for overload protection.



CONTROLS

Because various metal finishing jobs are best regulated by different types of controls, Wagner Brothers Germanium Rectifiers can be provided with any popular type of manual or automatic control: tap switch, powerstat, remote saturable reactor, mechanical magnetic reactor, etc. Controls are either situated as an integral unit on the rectifier cabinet or can be used as a remote control at any location within the plant.



TRANSFORMERS

Transformers are of our own design and manufacture, provided with Class B non-flammable insulation (glass, mica, asbestos, etc.) for safety and extra long service. They are specially designed for metal finishing applications.

COMPACT

Wagner Brothers Germanium Rectifiers are made in two basic cabinet sizes:

28″ x 28″ x 64″.....up to 3,000 amperes
28″ x 52″ x 64″.....4,000 to 6,000 amperes

All major components contained within the sturdy housing are easily reached for the minimum of maintenance required.

Wagner Brothers also offers a complete range of types and sizes of selenium rectifiers.

Important features . . .

which make this a truly permanent rectifier!

HEAVY-DUTY TRANSFORMER

Conservative class B design.

EFFICIENT GERMANIUM STACKS

Up to 95% efficient, hermetically sealed cells do not age. Individually protected against current faults.

CENTRIFUGAL BLOWER

Large capacity. No maintenance. Separate overload and thermal protective devices. 3-phase motor.

CONTACTOR

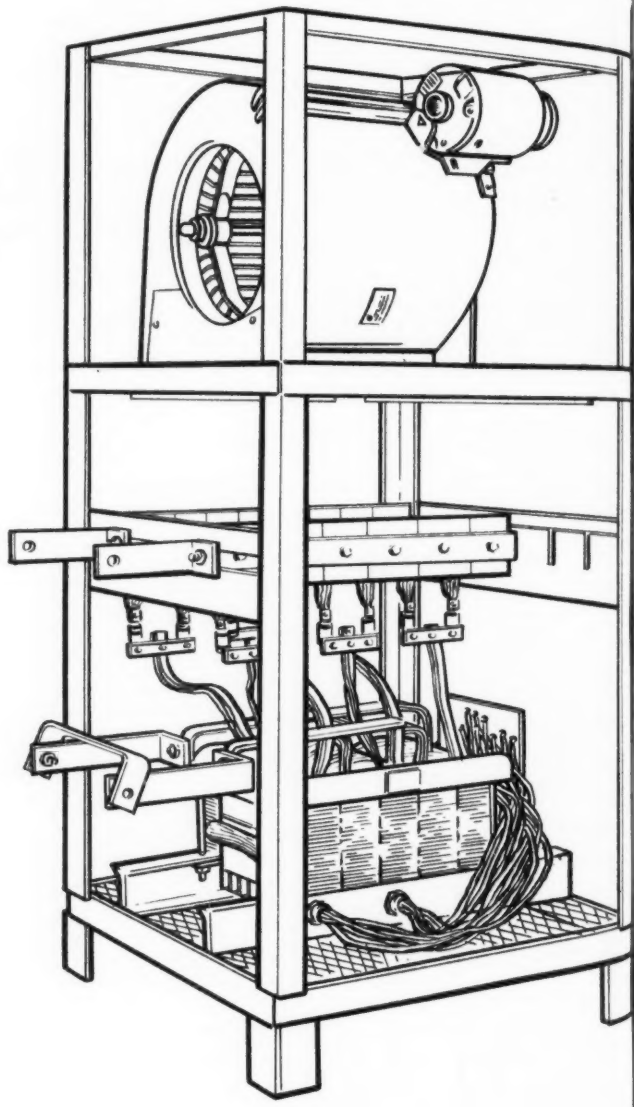
With separate thermal breaker for gradual overload protection.

CIRCUITS

3-phase circuit protected against single phasing. Low voltage circuits built-in.

CONTROLS

Separate or part of cabinet. May be located anywhere in plant.



400 MIDLAND AVE., DETROIT 3, MICHIGAN

Look in the "Yellow Pages" in—

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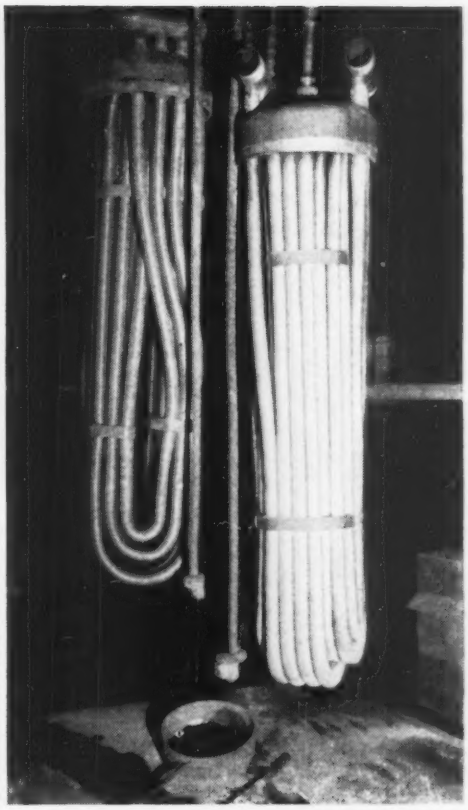
Wagner BROTHERS INCORPORATED

YOUR *PRIMARY* SOURCE FOR PLATING AND METAL FINISHING EQUIPMENT AND SUPPLIES



Acme Industries, Inc., Jackson, Michigan, well-known manufacturers of air-conditioning and refrigerating equipment, use Wyandotte 90 to clean and remove copper-oxide tarnish from finned-tube copper coils. Right: coils before and after cleaning.

Electrocleaning with Wyandotte 90 saves Acme Industries over $100 weekly

"Before switching to WYANDOTTE 90," says Acme's master mechanic, Ward Swarthout, "we had been using a proprietary electrocleaner for soil removal, then a rinse, and an electrolytic cyanide treatment for oxide removal on refrigeration condenser coils. The danger involved in using sodium cyanide, plus the expense of its purchase, handling, and waste disposal made it undesirable."

Looking for a more efficient, economical way to clean and brighten these coils, Acme Industries found that WYANDOTTE 90 did the job in *one* operation, replacing the costly, time-consuming three-step process formerly used.

"Through elimination of the electrocyanide bath," Mr. Swarthout goes on, "WYANDOTTE 90 is saving us $100 a week — and that's just the cost of the cyanide alone. It doesn't take into account savings in time, and safer, cleaner work."

WYANDOTTE 90 is unique among electrocleaners in its ability to clean and brighten copper parts, or buffed copper before plating. In addition, it is an outstanding heavy-duty reverse-current steel cleaner, combining exceptional properties of smut removal, chrome tolerance, and controlled foam.

To test WYANDOTTE 90 for your electrocleaning, call your Wyandotte representative or jobber. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

WYANDOTTE CHEMICALS CORPORATION
Wyandotte, Michigan

☐ **Please send further information on Wyandotte 90**
☐ **Have representative call**

Name_____

Company_____

Address_____

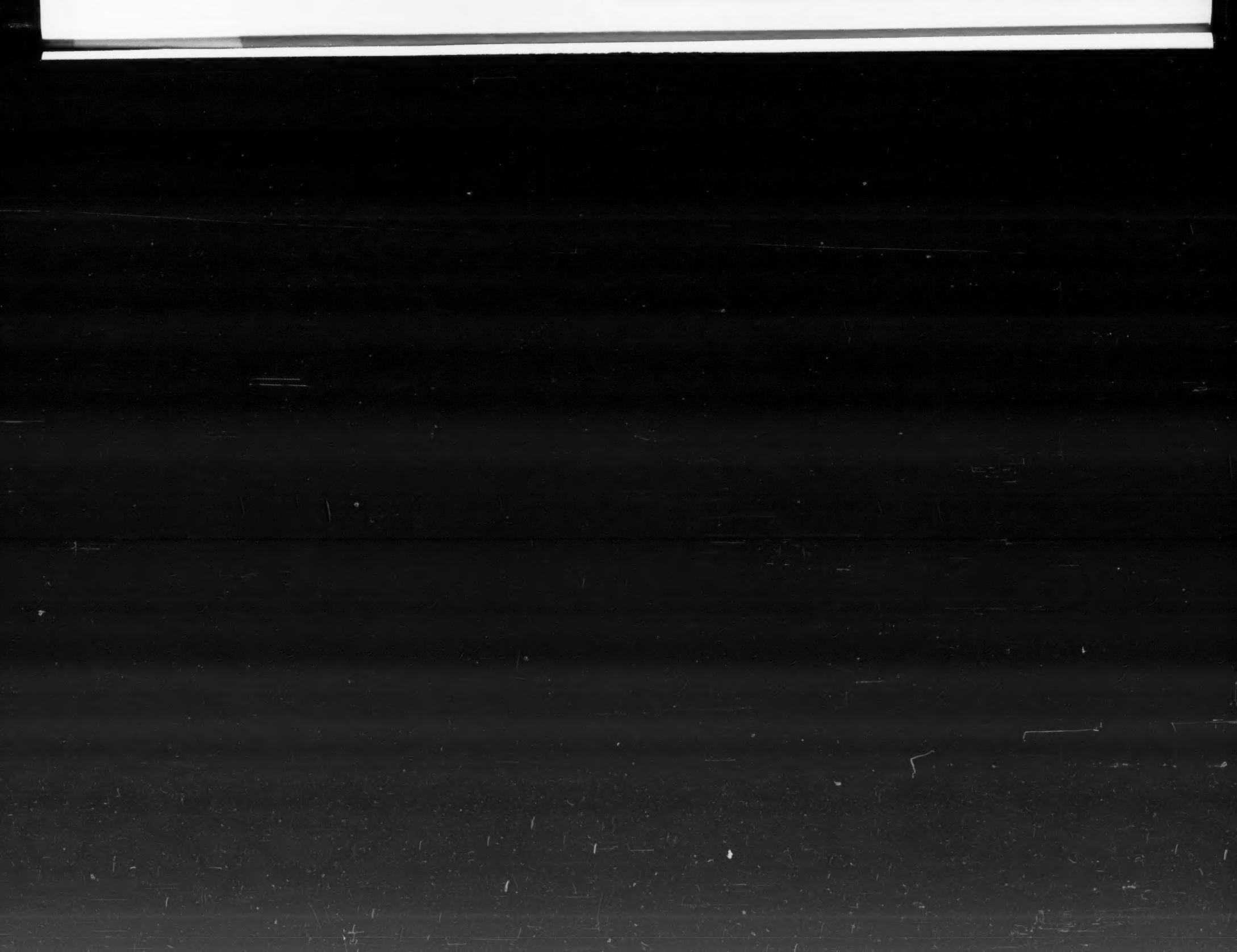
City_____ Zone____ State_____

Wyandotte CHEMICALS

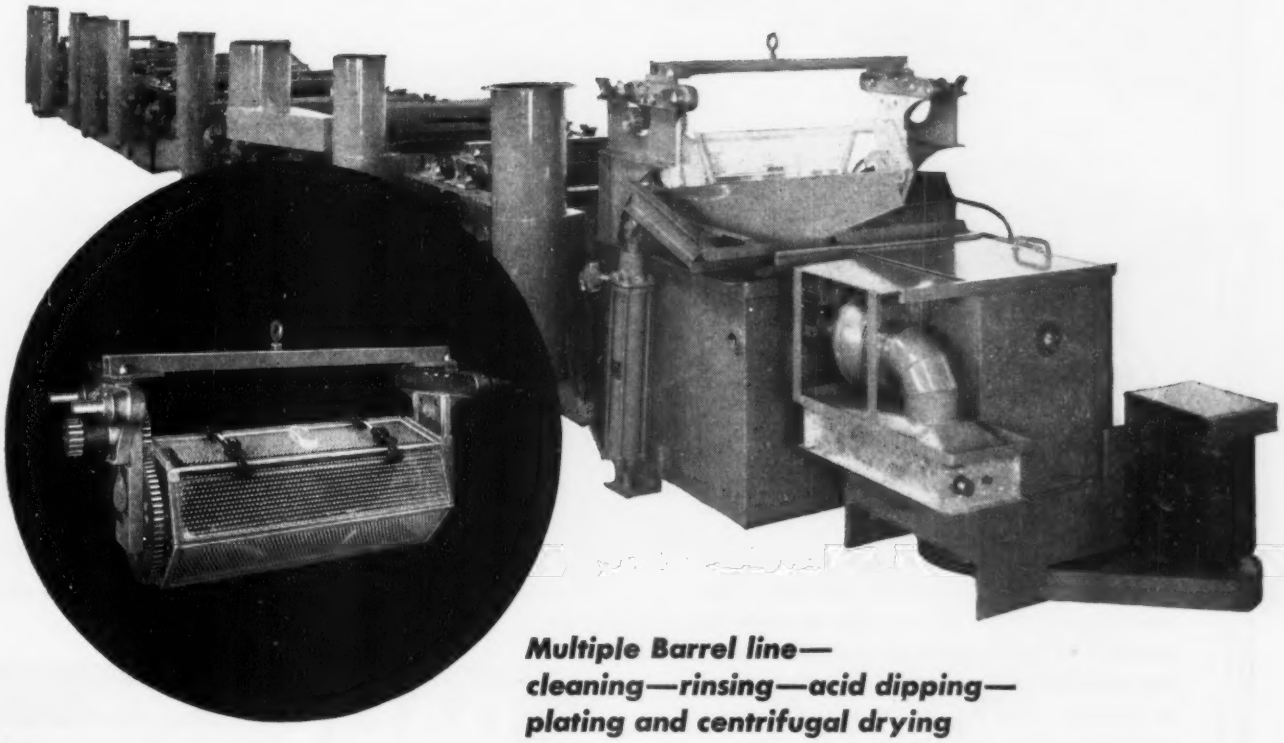
J. B. FORD DIVISION

SPECIALISTS IN METAL-CLEANING PRODUCTS

956



CROWN PLATING BARRELS



Multiple Barrel line—
cleaning—rinsing—acid dipping—
plating and centrifugal drying

CROWN LUCITE CYLINDERS

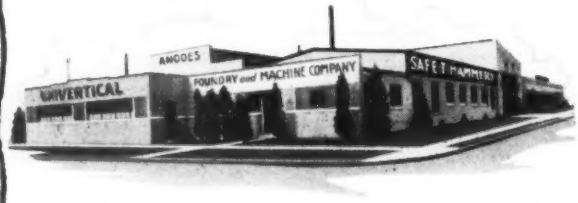
Can be operated through the entire cycle
cleaning—rinsing—acid dipping—and plating solutions.

Whether your production requires a single barrel
or a multiple set up for cleaning, rinsing, acid dipping, and
plating, there are Crown barrels to fit the job.

Write for complete details

CROWN RHEOSTAT AND SUPPLY COMPANY
3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

Super-Market for ANODES



buy DIRECT from METAL CONVERTER

Nickel anodes up to 93 inches in length —cast in new shell mold process. This unique method of casting produces anodes of the highest purity—with optimum metallurgical properties. Density of anodes is at a maximum and excellent surface is obtained. These factors account for longer life in plating bath.

NICKEL RECASTING PRICE SCHEDULE

ANY QUANTITY only 99+ purity accepted

15c PER POUND

FOB UNIVERTICAL

Laboratory Controlled

Write or wire for best price and delivery on the following Anodes:

Copper-Electro Deposited	Phos. Copper
Copper-Cast Round 3" Dia.	White Brass
Copper-Cast Round 2½" Dia.	Zinc
Copper-Cast Beehives	Tin
Copper-Cast Balls	Lead
Copper-Forged Balls	Carbon
Copper-Rolled Oval 1½" x 3"	

UNIVERTICAL
FOUNDRY AND MACHINE COMPANY
14841 MEYERS RD. • Broadway 3-8000 • DETROIT 27, MICHIGAN

SINCE 1939

THE MASTERS' ELECTRO-PLATING ASSOCIATION, INC.
of NEW YORK
59 EAST FOURTH STREET
NEW YORK 3, NEW YORK

is proud to announce its

38th Annual

Banquet and Entertainment

to be held

SATURDAY, MAY 12, 1956

in the

STARLIGHT ROOF of the
WALDORF-ASTORIA
NEW YORK CITY

Reception & Cocktails 6:30 P.M. — Banquet 8:30 P.M.

Subscription - - - $25.00 per person

The DALIC PROCESS OF ELECTRODEPOSITION

Used extensively throughout the Aircraft, Electronic, Electrical and Allied Industries for localized and "on site" plating.

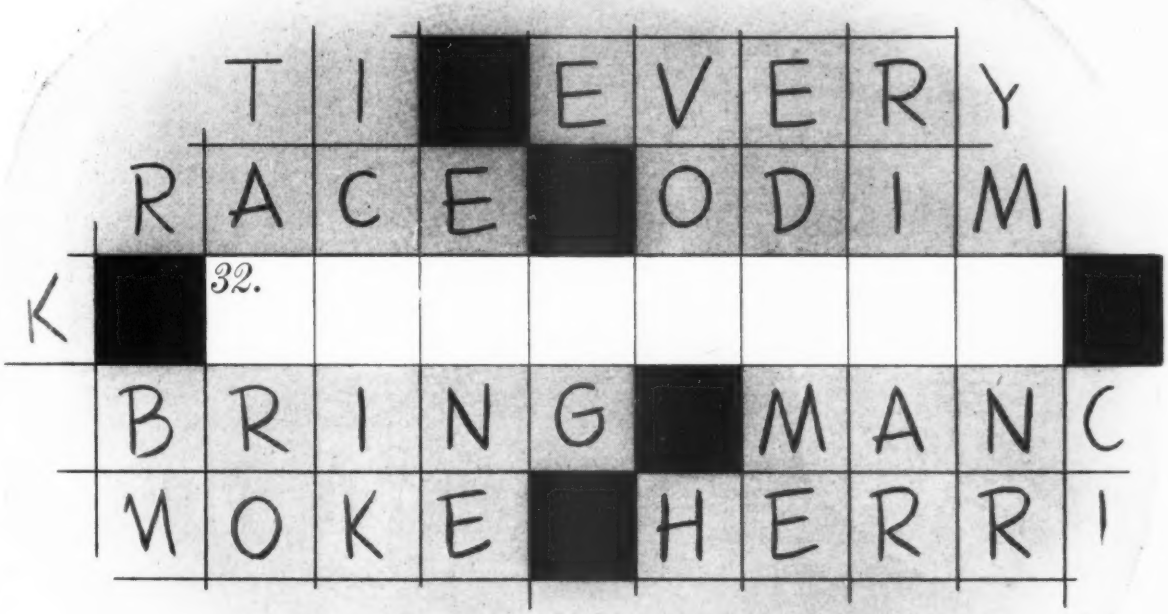
Deposit	Maximum Current Density Amp./ft. 2	Time to Deposit 0.0001 in.* (secs.)
Cadmium	6.000	2.5
Chromium	4.000	63.0
Copper	6.000	2.5
Germanium	4.000	—
Gold	2.000	6.2
Indium	4.000	2.5
Iron	3.000	10.2
Lead	5.000	3.8
Nickel	5.000	5.1
Nickel (Black)	5.000	—
Platinum	3.000	17.5
Rhodium	3.000	70.0
Silver	1.250	5.1
Tin	5.000	2.5
Zinc	3.000	3.8

* On an area equal to the pad electrode used.

DALIC METACHEMICAL LIMITED
121 Leicester Ave., Toronto 18, Canada - BE. 3-2129

MARLANE DEVELOPMENT CO., INC.
153 E. 26th. Street, New York 10, N.Y. - MURRAY HILL 5-9427

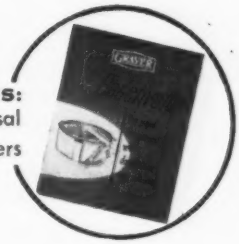
32. *Method of Treating Plating Waste*



RECOVERY? DISPOSAL?

There is no one process that will solve all plating waste problems. Experience has shown staff and consulting engineers that the correct solution can be obtained only by thoroughly evaluating all the factors in each case.

Whether the answer is recovery, disposal or a combination of both, Graver has complete equipment to do the job. Graver's 50 years of liquid treatment experience has resulted in equipment of advanced designs and engineered flexibility to suit individual requirements.



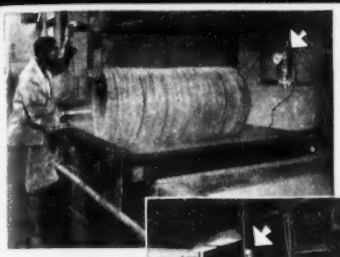
WRITE FOR TECHNICAL ARTICLE AND BULLETINS:
T-136: Plating Waste Solutions; Recovery or Disposal
WC-103A: Reactivators • WC-111: Ion Exchangers

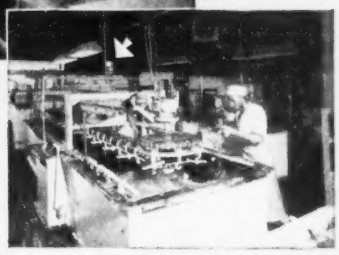
GRAVER®

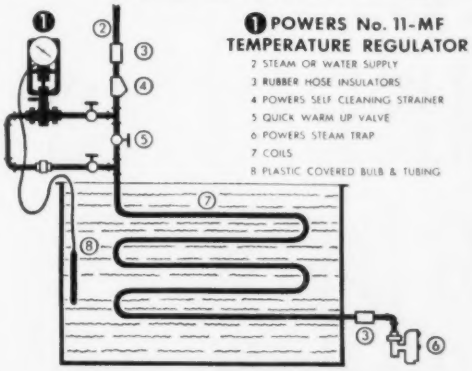
Industrial Waste Treatment Dept: W-211
GRAVER WATER CONDITIONING CO.
Division of Graver Tank & Mfg. Co., Inc.
216 West 14th Street, New York 11, N. Y.

Cut Cost of Metal Finishing Processes

and Get Better Quality Products

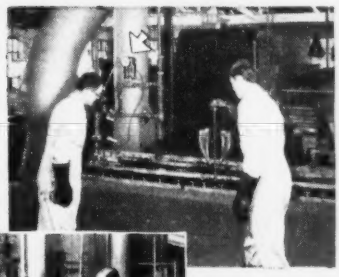


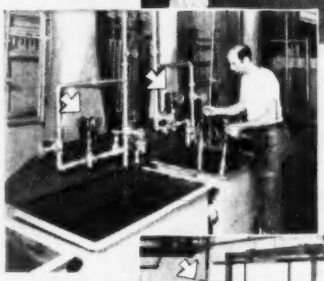


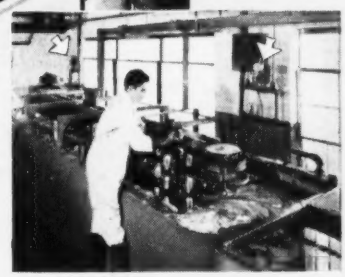


Holds Temperature Where You Want It.

USED BY LEADERS IN THE INDUSTRY







Install POWERS

No. 11-MF Self-Operating Temperature Regulator
Saves Labor and Steam, prevents solution "boil-over"
Helps get most effective use from various solutions

Plastic Covered Thermal Bulb and Tubing are highly resistant to metal finishing solutions. Prevents electrical shorts. No insulators are required for the regulator.

Easy to read 4" Dial Thermometer indicates temperature of solution under control. It gives a visual check of the process and makes it easy to adjust regulator for different temperatures.

Eliminate "the human element" in temperature control with Powers automatic Regulators. They're simple, compact and dependable. They stop OVER-heating, prevent "boil-overs," waste of steam, water wasted by evaporation, burnt plated parts, rejected anodizing, decomposition of costly additives and loss of volatile ingredients from some cleaning solutions. (b69)

Phone or write your nearest Powers office for Bulletin 330

POWERS CONTROL

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS • Offices in Over 50 Cities in U. S. A., CANADA and MEXICO

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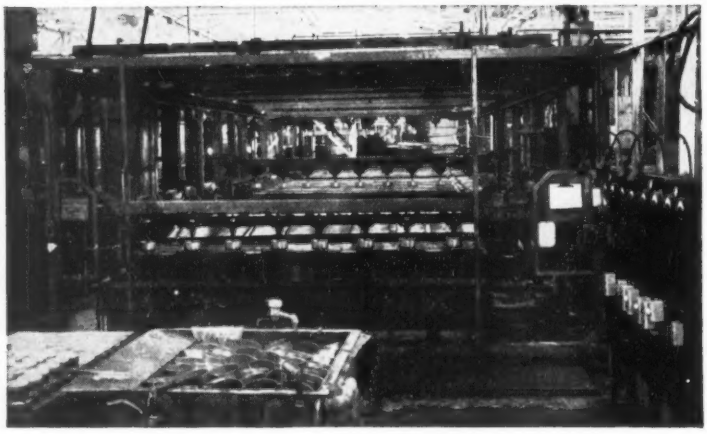

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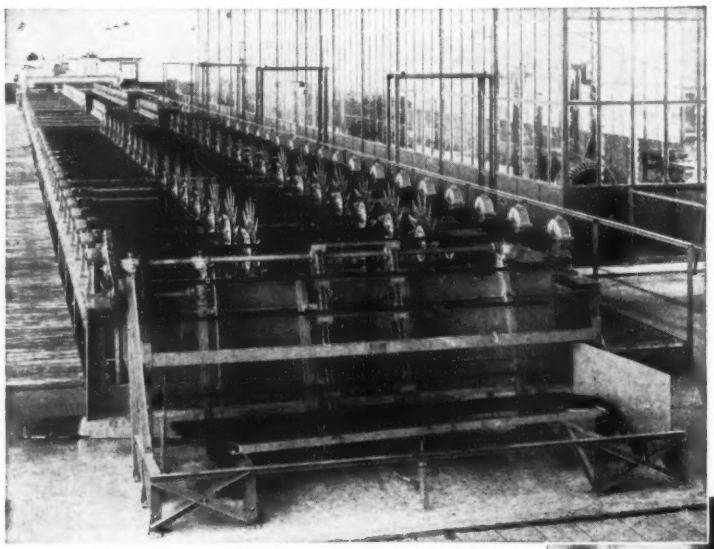

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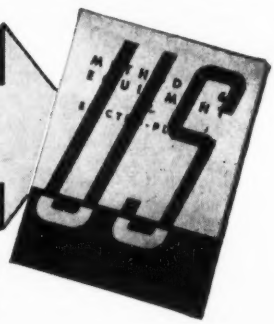

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How Much Longer?

Salt spray testing is a sore point with one editor, as readers of this page have probably begun to suspect by this time. Year after year we have pointed out that reproducibility, the criterion of any standard test, was completely unobtainable. Year after year, in the forty years or so since the test began to fascinate specification writers, apologies have been offered for it, and attempts made to justify the test on the ground that we have nothing better. Investigations by the dozen, for the purpose of improving the test method, have only resulted in unearthing more variables which were found to affect the results, including some which are practically impossible to control to the necessary degree.

ASTM, the authority referred to universally for competent specifications, is exceptionally thorough with regard to their development. It was, therefore, with faith and hope that we attended the recent Buffalo, N. Y. symposium of the Society to hear the report of the committee charged with the latest study, in which duplicate panels were plated in various plants and submitted to the "standard" salt spray test by four different laboratories.

In what was admittedly a difficult situation, *Dr. A. Mendizza* of Bell Telephone Labs., who presented the report, acquitted himself nobly and with a rare humor which went far toward lessening the disappointment. But, what suggestion can be offered when test results vary so widely that even the statistician, who can usually be depended upon as a last result to draw some conclusion from otherwise unusable data, throws up his hands? It was suggested that the lack of reproducibility was the result of inconsistency of the test panels, the platers, the test conditions, and the testers. Presumably, there isn't a thing wrong with the test itself!

Of course, the salt spray test will always have some value in a limited sphere. However, it's time we faced up to the brutal fact that it is not a valid acceptance test and it is doubtful whether, in the foreseeable future, it can be made reproducible. It hasn't over a period of forty years! Since, in the case of sacrificial metals such as cadmium and zinc, a thickness test will give as much information and, in the case of cathodic deposits such as copper and nickel, we are doing nothing more than testing the porosity, there is no valid reason for the universal insistence on salt spray performance tests.

Those well versed in the subject are fully aware of the disadvantages of present porosity test methods. These also present the problem of reproducibility. But, if we are to be saddled with a non-reproducible test method, it might as well be an easy one and we will have gotten rid of the bane of the metal finisher's existence.

Nathaniel Hall

Stress in Electrodeposited Coatings

Its Significance and Measurement

By Joseph B. Kushner, *Director, Electroplating School, Stroudsburg, Pa.*

ANY plater who has observed cracked or peeling deposits on drawing a rack of work out of a bright nickel tank, knows the meaning of stress, first hand. Obviously, the subject is not new! Yet, in spite of its importance, stress received only sporadic attention in plating circles until about ten years ago. At that time, when the demand for cars was ravenous beyond measure, a sudden epidemic of defective nickel deposits, particularly on bumper bars, plagued Detroit production men into instituting some serious research into the cause and control of stress in electrodeposits. They discovered some surprising things and they awakened considerable scientific interest in this long neglected problem. Many investigators have delved into it since then but, to this day, the cause of stress in electroplated coatings is almost as much a mystery as when Gore[1] first made documentary reference to the phenomenon in 1855.

What is stress anyway? To make things simple we'll confine our thoughts to a metal bar though the principles are applicable to almost anything. Suppose we take a metal bar of length L and cross sectional area A, clamp it rigidly at one end and attach a weight of W pounds to the other end, as shown in Fig. 1. The weight acts to deform, or stretch the bar. This deforming force is resisted by an opposing force generated in the bar (Newton's Third Law: Action equals reaction). Some slight stretching of the bar, ΔL, will occur until the force generated in the rod is exactly equal to the applied force. At this point the forces are balanced and there is no further extension of the bar.

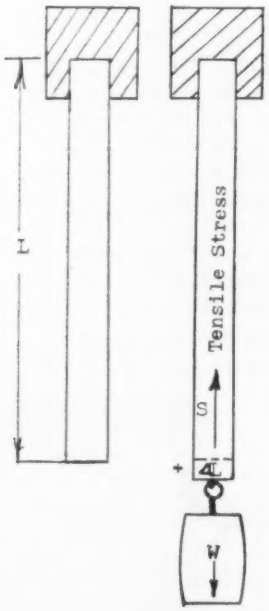


Fig. 1. Tensile Stress.

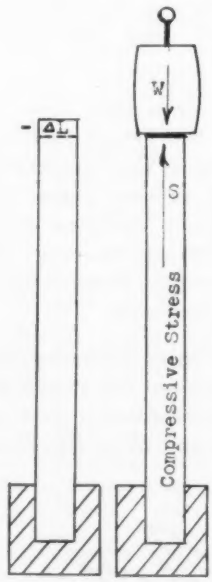


Fig. 2. Compressive Stress.

The resisting force generated in the metal is known as the *stress*. Usually in speaking of stress we refer to a unit stress, which is simply the force exerted per unit area. Thus in the bar, the stress, S, is equal to W/A. The deformation (elongation in this case) ΔL, is known as the *strain*. In speaking of strain what is usually meant is the unit strain, which is the elongation (or contraction) per unit length, or $\Delta L/L$, or e.

The kind of stress generated in the case of Fig. 1 is known as a *tensile* or *contractile* stress, because it is acting to contract the bar against the tensile force exerted by the weight. When the applied force acts in the opposite direction as shown in Fig. 2, where the weight is resting on the free end of the bar, the force generated in the metal is called an *expansive* or *compressive* stress because it acts to keep the bar expanded against the compressive force of the weight. These are the two general types of stresses that are found in plating practice. There is also a *shearing* stress which is so named because it acts to resist forces producing shearing action, but this will not be considered here as it rarely comes up in electroplated coatings.

In 1676, the British physicist Hooke discovered the universal principle that connects stress with strain. He carefully guarded his discovery by means of an unintelligible anagram, "ceiiinossttuv," which he unscrambled two years later into the Latin phrase, "Ut tensio sic vis," which meant, "As the force, so the extension." In modern terminology, we say the strain is proportional to the stress.

If we plot a curve of stress versus strain for the metal bar, we get something like the result shown in Fig. 3. Up to point P, the curve is a straight line, showing the proportionality discovered by Hooke and, in this range, the bar is behaving *elastically* (the bar will snap back to its original length the moment the load is released). Beyond this point however, as the stress is increased, the strain is no longer proportional

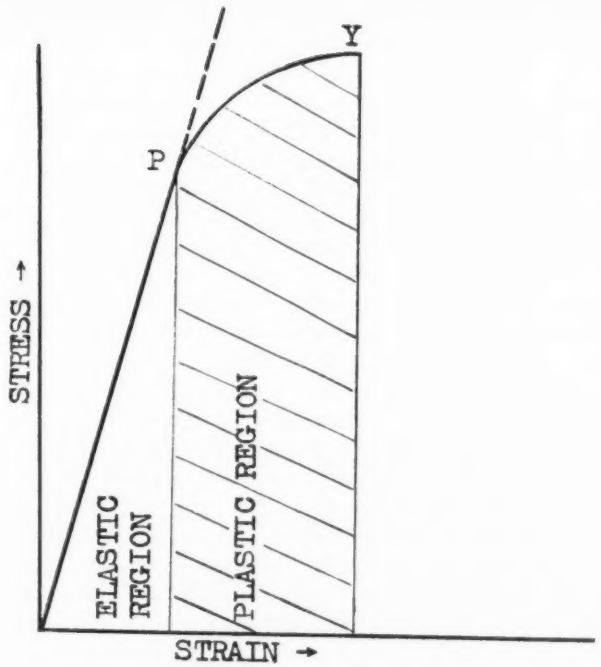


Fig. 3. The Stress-strain curve (idealized).

and a small increment in stress produces a much larger increment of strain than before. This point is therefore called the *proportional limit*. It is also, for all practical purposes, known as the *elastic limit* because, beyond this point, if the stress is released the bar will no longer spring back to its original length. It will go back only part way and thus there will be some permanent deformation. The region beyond P, where some permanent deformation takes place is known as the *plastic* region of the curve. The *yield point* is that point on the curve where no additional stress need be added to produce a marked increase in strain. On the curve it is represented by Y.

Hooke's Law stated mathematically is

$$\frac{\text{Stress}}{\text{Strain}} = \text{A Constant.}$$

Stress is the force per unit area and strain is the change in length per unit length so that, for the bar, the relationshop would be $\frac{W/A}{\Delta L/L} = E$ where E is the constant, also known as the *modulus of elasticity* or *Young's modulus*, after the scientist who carried out extensive experimental work on this basic relationship. In more concise mathematical shorthand, $S/e = E$.

For steel and nickel, the value of E is 30×10^6 psi (lbs./sq. in.). This means that, if the bar were made of steel and had a cross sectional area of one square inch, it would take a weight of 30,000,000 pounds to extend the bar by its own length! In actuality this is not so because the yield point of steel is roughly 30,000 psi in actual test. The value of Young's modulus for nickel is also 30×10^6, whereas for copper it is 15.6×10^6 or roughly half.

Now we can also speak of internal and external stress. The difference between the two is simple. If the force which produced the stress is one which was applied from outside of the bar, the stress is an external stress. If it is applied from inside the bar, the stress produced is an internal stress. In speaking of internal stresses however, we usually refer to them as *residual* or *locked in* stresses because frequently these internal stresses cannot be released. In electroplating, we have to deal with this type of a stress. While internal stress may be caused by several factors, the most common cause in all cases and probably the only cause in electrodeposits, is that due to a change in volume.

Internal stresses of enormous magnitude can be caused by relatively small volume changes when such changes are restricted or restrained. A simple example will prove this. Suppose we take the steel bar of the previous example and clamp it immovably at both ends. Now we put a cooling coil around it (Fig. 4). How much would we have to cool the bar in order for the bar to become permanently deformed (reach the yield point)? And what would be the change in volume required to set up such a stress?

The change in length of the bar as the bar is cooled is given by $\Delta L = La\Delta T$ where a is linear expansion coefficient of steel per degree and ΔT is the temperature difference set up by the cooling coil, in degrees. Accordingly, $\Delta L/L = a\Delta T$. In order to prevent such a contraction we would have to exert a force S, equal to $E(\Delta L/L)$. If we substitute $a\Delta T$ for $\Delta L/L$ in the second equation, we get $\Delta T = S/Ea$. The yield point of ordinary steel is about 30×10^3 psi and the linear expansion coefficient is 6.2×10^{-6} inches per degree Fahrenheit. Accordingly, the temperature difference required to produce the deforming stress will be equal to $\frac{30 \times 10^3}{6.2 \times 10^{-6} \times 30 \times 10^6} =$ 159°F. The volume change equivalent to this relatively small temperature change is approximately only 0.1%. In other words, a restricted volume change of 0.1% brings into play a destructive force of 30,000 psi, on the steel bar!

Still considering volume changes as a cause of internal stress, suppose we take the steel bar and heat it uniformly from the top side as shown in Fig. 5. The heat entering the first thin layer imparts more energy to the atoms therein and the layer expands. The expansion is resisted by the cool steel below. The only way the outer layer can increase its surface area is by bending the steel bar so that it bulges out slightly. The volume increase in the outer layer has caused a compressive stress in that layer because the increase is restrained by the cool steel below. This is a transitory internal stress because, soon as the whole bar reaches the same temperature, the inner fibers of the bar will expand as much as the outer ones so they will not exercise any restraint; there will be no

Fig. 4. Restrained uniform cooling produces large tensile stress.

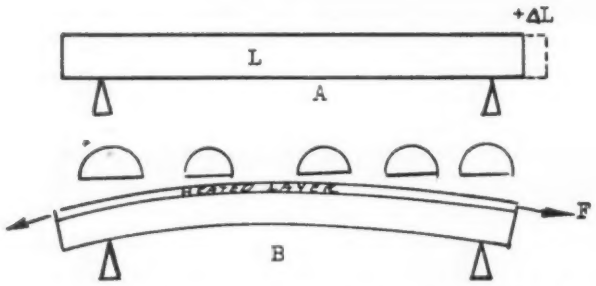


Fig. 5. A. Uniform heating produces no stress when bar is not constrained.

B. Compressive stress produced when bar is non uniformly heated.

resistance to volume expansion and the stress will vanish.

On the other hand suppose we cool the outer top layer of the bar by means of a cooling coil. The outer layer will now shrink. This shrinkage is resisted by the warmer parts of the bar, below. In order for the outer layer to occupy a lesser volume it will bend the bar so that it is concave up as shown in Fig. 6. This stress is likewise a transitory one because as soon as the bar is uniformly cold the contraction is no longer resisted, the stress vanishes and the bar straightens out.

In electroplated coatings we have a condition somewhat similar to that in the heated or cooled layers of the metal bar, except that the stresses are no longer transitory. For example, for some as yet unexplained reason, most ordinary nickel deposits shrink in volume. Thus they act on the basis metal like the outer cooled layer in the previous example. If the basis metal is not too thick and rigid it will dish in. On the other hand, if we plate out zinc, the deposit is usually in compressive stress due to the fact that the deposit expands. This causes the basis metal to bulge out just as though the outer layer were at a higher temperature. Bending is the only way these stresses can relieve themselves. If the basis metal is too heavy and rigid to bend, the stresses are "locked in" the deposit. These residual stresses are the mischief makers.

Now let us look at this phenomenon of stress from the practical viewpoint. How does it effect plating?

Effects of Stress in Plating Practice

PLATE ADHESION:

The basic problem of the plater is to get the plate to stick to the work. *Stress in an electrodeposit can act to weaken adhesion or strengthen it.*

Consider a deposit in which the stress is compressive. It seeks to stretch out over the surface of the basis metal and in so doing exerts a force that pushes it into the basis metal which improves the adhesion between the two. Fig. 7 shows why such a stress helps keep the deposit on the work. It is something like stretching out one of those spring exercisers between your two hands. As the hands pull the spring apart the coil comes closer to the body and stays closer to it. In the case of the plate, the force stretching it comes from inside the plate, but the reaction is the same; there is a component of the pull acting to hold the plate closer to the body of the work.

On the other hand, in a nickel deposit where the stress is contractive, as can be seen from the diagram, the component in the direction of the adhesion force, acts to pull the deposit away from the basis metal. This effect is likewise seen in permitting a stretched spring exerciser to contract between the hands; the coil moves away from the body as it does so.

The force of adhesion between nickel and steel, where the cleaning is perfect, is very high, certainly at least as high as the yield strength (30,000 psi), if not more. If the cleaning is poor, however, the adhesion force between the two which is basically atomic in nature, may run as low as 100 psi or less! Practically speaking then, this means that if the tensile stress in the nickel plate is high and the cleaning was mediocre or poor, the nickel deposit will peel off. If the tensile stress in the nickel is normal (about 15,000-20,000 psi for the average Watts bath) and the cleaning is good, the deposit will adhere fairly well. Now, if the stress could be made compressive, and the cleaning is still poor, there would still be a good chance for the deposit to adhere. To put it another way, *a deposit with a high tensile stress is a bad risk when it comes to adhesion.*

CRACKING OF DEPOSITS:

Once in a while cracks will be discovered in a nickel deposit. Sometimes they can be seen right as the work comes out of the tank, sometimes they develop a short while later, sometimes after the part is in service. When this occurs, it means that the tensile stress in the deposit was so high that it actually exceeded the tensile strength of the nickel. The stress relieved itself by cracking the deposit. Here again, there is a battle between two forces, tensile stress and ductility. Ductility is a measure of the amount of *plastic* deformation a metal can undergo in tension without breaking. It is intimately connected with the tensile strength of the metal and its plasticity, which means ability to flow under applied forces. Nickel as a metal has low plasticity but it does have a high tensile strength. The combination results in only fair ductility. In plating it out, the ductility may be greatly decreased because impurities plated out along with the nickel reduce the plasticity and the tensile strength.

If the nickel deposit has a fair amount of ductility, then any stress in the deposit will act to deform the

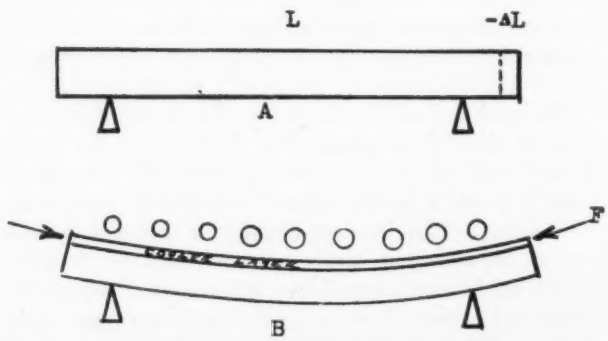


Fig. 6. A. Uniform cooling produces no stress when bar is not constrained.

B. Tensile stress produced when bar is non uniformly cooled.

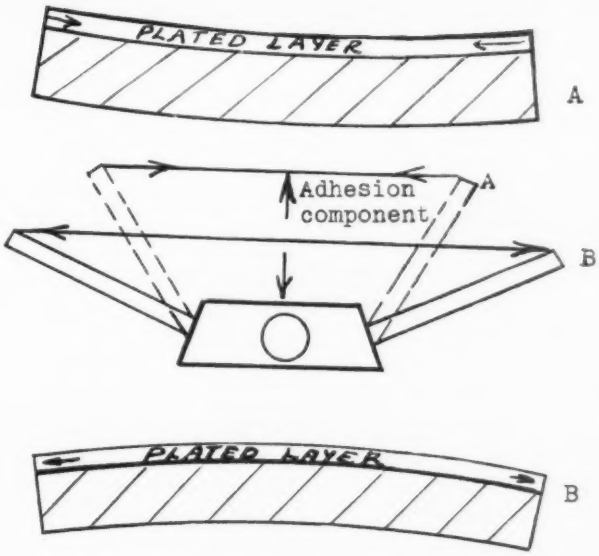


Fig. 7. Effect of stress on adhesion. (A) Tensile Stress. (B) Compressive Stress.

deposit and the stresses will be partially relieved by the metal taking a permanent set. If the nickel deposit is brittle (has low ductility) then the nickel deposit does not flow under the stress but simply cracks and, in this way, the stress is relieved.

As pointed out by Such,[2] the ratio of stress to ductility plays an extremely important role in the control of bright nickel plating baths. It is even more important from the practical control view point than is a chemical analysis because, long before impurities in a nickel bath give rise to visible defects, the stress and ductility of the plate undergo marked changes.

When the stress in the deposit is high and the ductility is low, the nickel deposit cracks at once and the cracks can be seen right as the part comes out of the bath. When the stress is high and the ductility is borderline, cracks may be found a short time after the work is removed from the bath, particularly on zinc die castings where there is a considerable difference in the expansion coefficient of the zinc alloy and the nickel deposit (On cooling additional stress is put on the nickel deposit). In the field, parts may show nickel cracks after they are put into service because either additional tensile stresses are developed by the application of external forces (see under *fatigue strength* below) or because of stress corrosion (see also below). If a metal is deposited in compressive stress, it is difficult, if not impossible, for cracks to originate in the plated coating.

Blistering:

On occasion, the blistering that is sometimes seen in cadmium deposits is the result of residual stress. Cadmium is usually deposited in a state of compressive stress so that the deposit tends to expand. If there is a localized region on the basis metal where the adhesion is poor due to bad cleaning, the expansion of the deposit in this region will be less restricted than over an area where the adhesion is good. As a result, the deposit will bulge out forming a blister. Fig. 8 shows how such a blister develops. Of course, it should be made clear that this is not the only cause of blistering.

Distortion:

If highly stressed deposits are plated on thin metal sections, the metal will be distorted in form in very much the same way as illustrated in Fig. 7. For high precision work or in such cases where even slight distortion is not allowable, stress in the deposits must receive serious consideration. Specific cases of this are often found in electroforming. Distortion of electroformed wave guides, for example, due to stress, can cause serious difficulties. Distortion can prevent or make difficult the removal of an electroformed item from the former or mandrel where non-expendible formers are used. Thus, suppose a 0.001″ deposit of nickel is put down on a 2″ diameter cylindrical mandrel. If the nickel deposit has an internal stress of 30,000 psi, it means that the deposit is pressing on the mandrel with a pressure equivalent to an external pressure of 30 psi. Under such conditions we have the equivalent of a shrink fit and it becomes next to impossible to remove the mandrel. From the standpoint of distortion an electroformed cylinder, for example, would show an error in diameter of more than 0.001″ for each inch of diameter, an extremely serious error where precision work is concerned.

Stress Corrosion:

In recent years, medical research has shown that people under stress are more likely to develop physical diseases. An analogous situation holds when it comes to stressed electrodeposits. It has been known for a long time that stressed deposits behave differently chemically than unstressed ones. They become less noble in the electromotive series. They dissolve faster in acids and other chemical reagents. They also may act as anodes with reference to areas that are less stressed or not stressed at all, thus making the metal prone to corrosion. A coating of nickel under high stress may develop surface cracks and pits in a corrosive atmosphere much more rapidly than a deposit with less internal stress. Once these cracks are opened up, the stress in the deposit is relieved and the nickel becomes more noble again and the underlying less noble metal is then readily attacked by the corrosive influences of the environment. Much more investigation must be done in this field, however, before any clear cut theory can be evolved.

Fatigue Strength Loss:

Metals subjected to repeated stresses suffer from fatigue failure. This type of failure may occur even

(*Continued on page 57*)

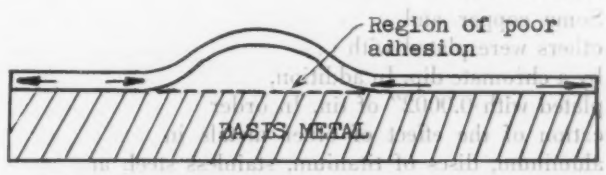


Fig. 8. Formation of a blister in a compressively stressed plate.

Galvanic Corrosion of Aluminum

By Fred Pearlstein, *Chem. Eng., Ordnance Corps, Frankford Arsenal, Philadelphia, Pa.*

Summary

COPPER in contact with aluminum results in greatly accelerated corrosion of the aluminum. Pitting corrosion at the junction of copper and aluminum is severe when the aluminum is anodized. When the aluminum is bare, the corrosion is distributed over a large area with less concentrated attack. Steel, titanium, nickel, and stainless steel cause significant attack upon bare aluminum. Tin does not cause greatly increased corrosion when in contact with aluminum, and the tin itself is unattacked. Cadmium is anodic to 24S aluminum and is, itself, sacrificially corroded.

Introduction

Certain ordnance uses for aluminum depend upon the corrosion resistance of anodized aluminum parts when in contact with steel or copper. Preliminary tests have shown that steel and, particularly, copper accelerate the corrosion of aluminum with which they are in contact. Corrosion results of other metals in contact with aluminum are reported herein. In particular, the desirability of electrodepositing cadmium or tin on copper or steel was investigated.

Procedure

Aluminum alloy 24S-T3 was used in these tests because of its widespread use. Panels (4″ x 6″) were cut from 0.025″ stock and a hole was punched in the center of each panel. All panels were prepared by cleaning with scouring powder and lightly etching. They were weighed to the nearest milligram. One set of panels was left bare while another was anodized for 30 minutes in 15 per cent sulfuric acid at 12 amp./ft.^{2} and sealed in hot 5 per cent sodium dichromate solution for 15 minutes. A third set of panels was anodized for 15 minutes and left unsealed to represent conditions of porosity somewhere between the other two sets. Additional panels representing each set were put aside in a desiccator and are referred to later as "weight-control" panels.

Discs of copper and steel about 2 inches in diameter were used to make galvanic couples with aluminum. Some copper and steel discs were used bare while others were plated with 0.0002″ of cadmium followed by a chromate dip. In addition, some copper discs were plated with 0.0002″ of tin. In order to get some indication of the effect of other metals in contact with aluminum, discs of titanium, stainless steel, and steel electrodeposited with 0.0004″ of nickel were included. The discs were bolted to the aluminum panels using plastic washers and rubber tape to prevent contact of the nuts and bolts with the discs or panels. Panels from each set assembled with polystyrene discs served as corrosion controls. With the exception of titanium, stainless steel, and nickel-plated steel, the couples were made up in triplicate with bare and anodized-sealed panels and in duplicate with anodized unsealed panels. Only single specimens of the titanium, stainless steel, and nickel-plated steel couples were used.

The specimens were exposed to salt spray and examined after 24, 72, 168, and 336 hours. All specimens were removed from salt spray after 600 hours exposure. After removing the discs the panels were immersed in a stripping solution made with 39 ml of 85 per cent phosphoric acid and 21 grams chromic acid per liter of water. The immersion time was 15 minutes with the solution held at 180°F. The panels were then brushed with scouring powder and dipped in acetone. The "weight-control" panels mentioned above were immersed in the stripping solution and brushed along with the test panels, and all were reweighed. By subtracting the change in weight of the "weight-control" panels from the total weight change of the corresponding test panels the weight of aluminum corroded during salt spray exposure was obtained. A further correction was applied by subtracting the average corrosion weight loss of the panels assembled with polystyrene discs to obtain an estimate of the corrosion due to galvanic effects.

Discussion and Results

After 24 hours in salt spray the bare panels were covered with white corrosion products; the panels anodized and unsealed showed light corrosion through pores in the coating; the anodized-sealed panels were unaffected. One of the panels of the set anodized and unsealed was inadequately coated and was corroded to the same extent as the bare panels. All of the panels with copper discs were severely attacked along the junction, by which is meant the area of the panel immediately adjacent to the edge of the disc.

After 72 hours in salt spray there was little change in the appearance of the specimens. However, several pits were visible on the body of anodized-sealed panels to which copper and stainless steel discs were attached. After 168 hours exposure the cadmium-plated discs all showed signs of corrosion.

ALUMINUM PANELS AFTER 600 HOURS' SALT SPRAY EXPOSURE

Bare | Anodized - Unsealed | Anodized - Sealed

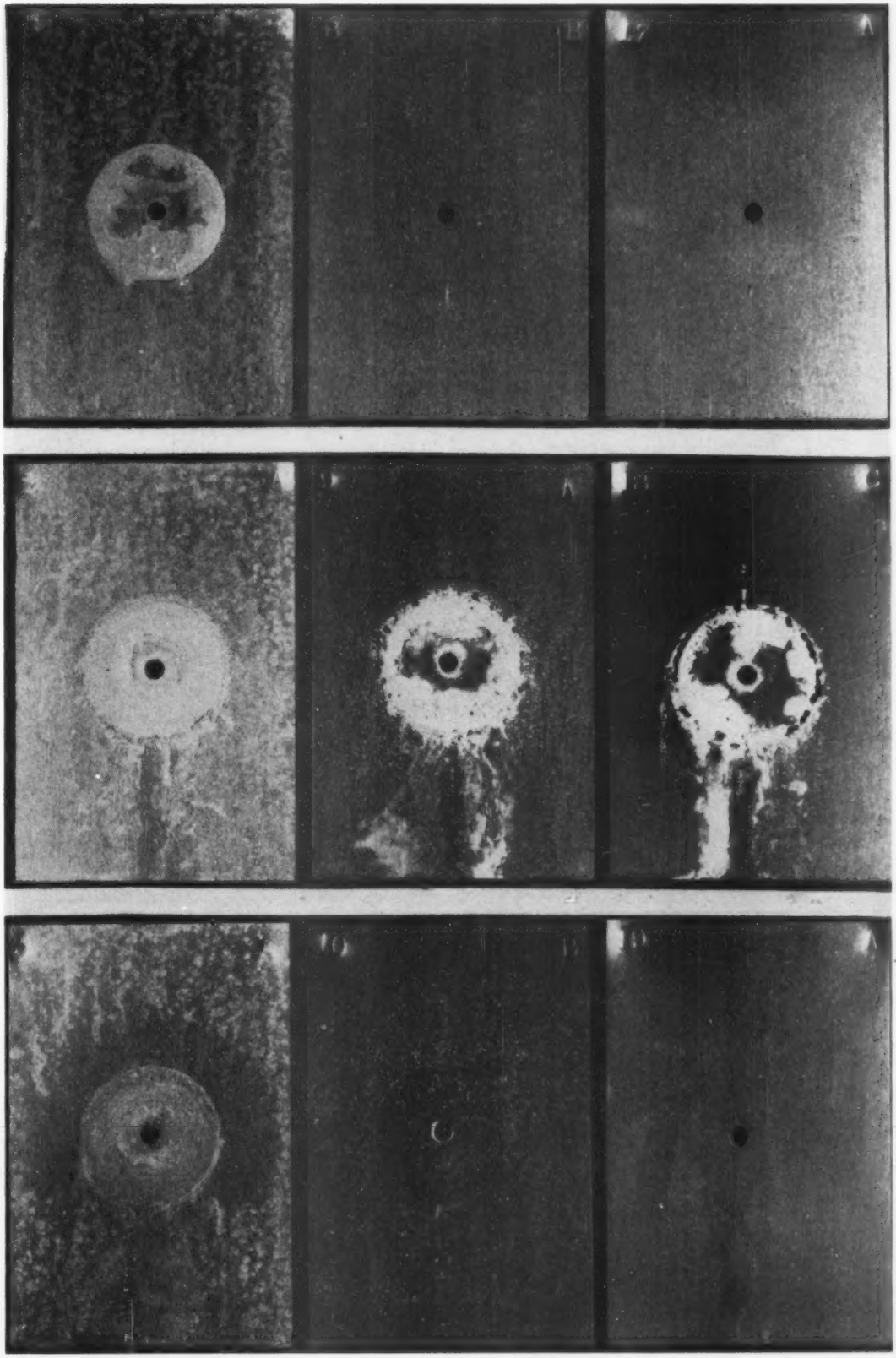


Fig. 1.
Polystyrene

Fig. 2.
Copper Disc.

Fig. 3.
Cadmium Plated
Copper Disc.

ALUMINUM PANELS AFTER 600 HOURS' SALT SPRAY EXPOSURE

Bare | Anodized - Unsealed | Anodized - Sealed

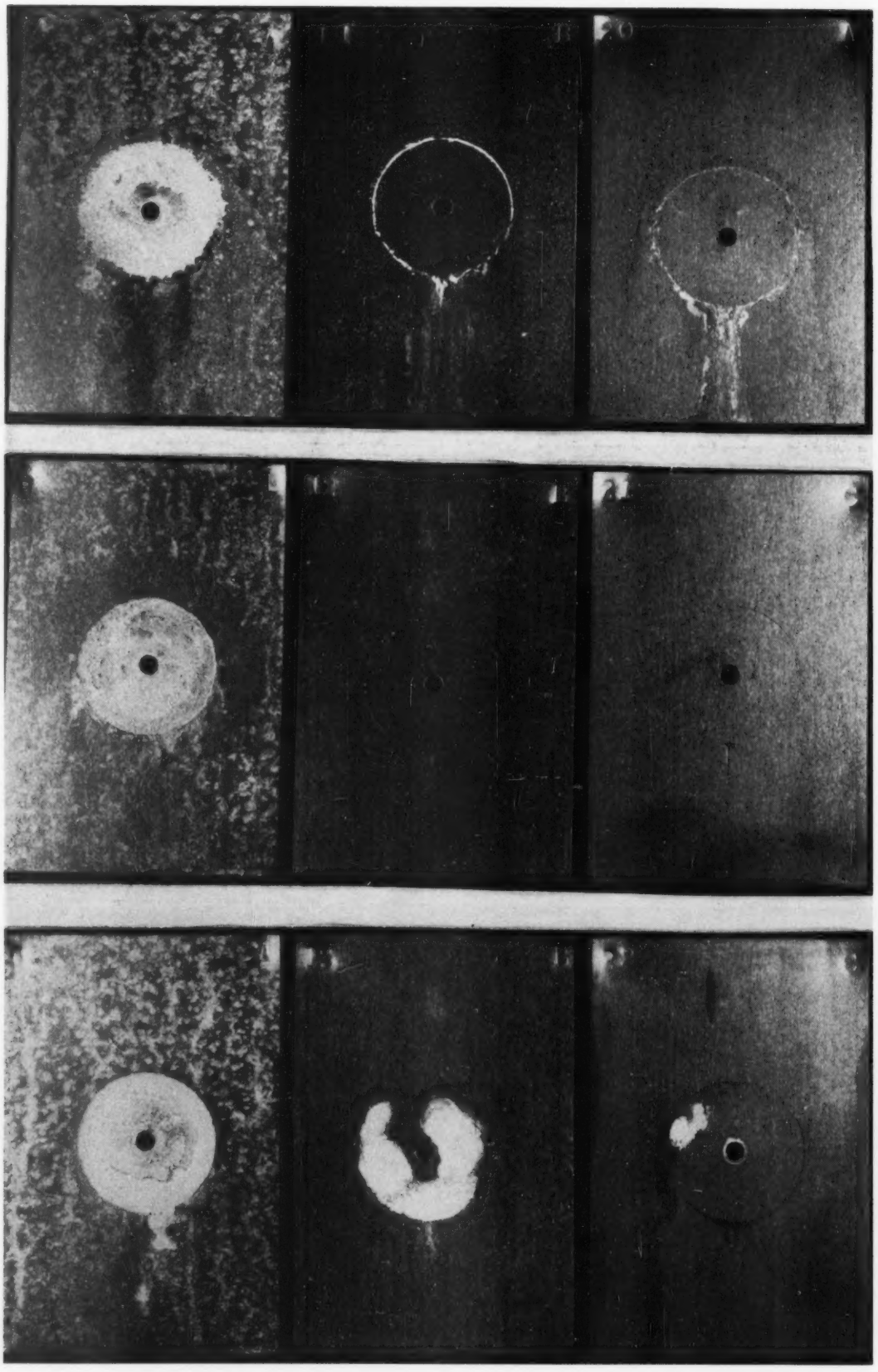


Fig. 4.
Steel Disc.

Fig. 5.
Cadmium Plated
Steel Disc.

Fig. 6.
Tin Plated
Copper Disc.

ALUMINUM PANELS AFTER 600 HOURS' SALT SPRAY EXPOSURE

Bare | Anodized - Unsealed | Anodized - Sealed

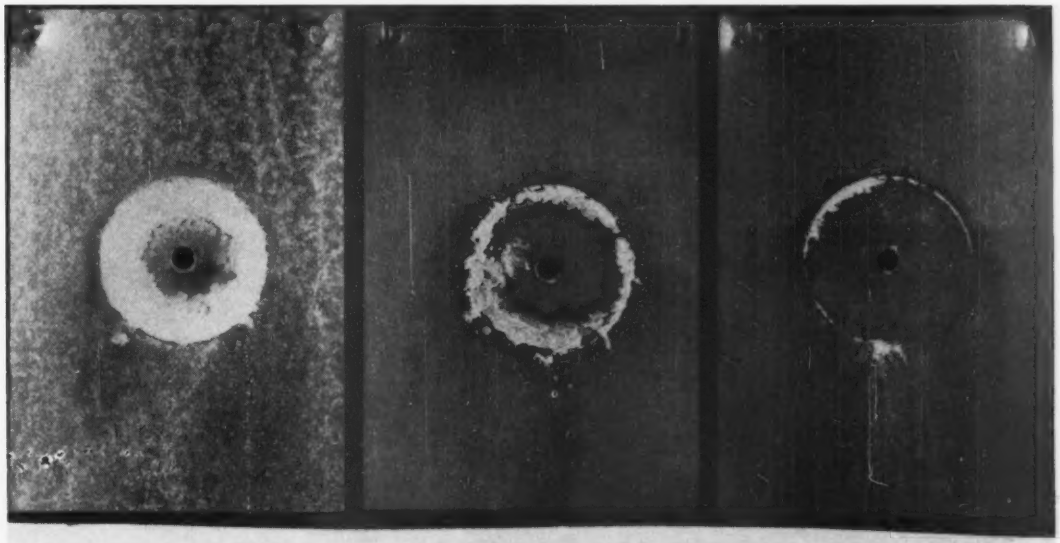


Fig. 7.
Nickel Plated Steel Disc.

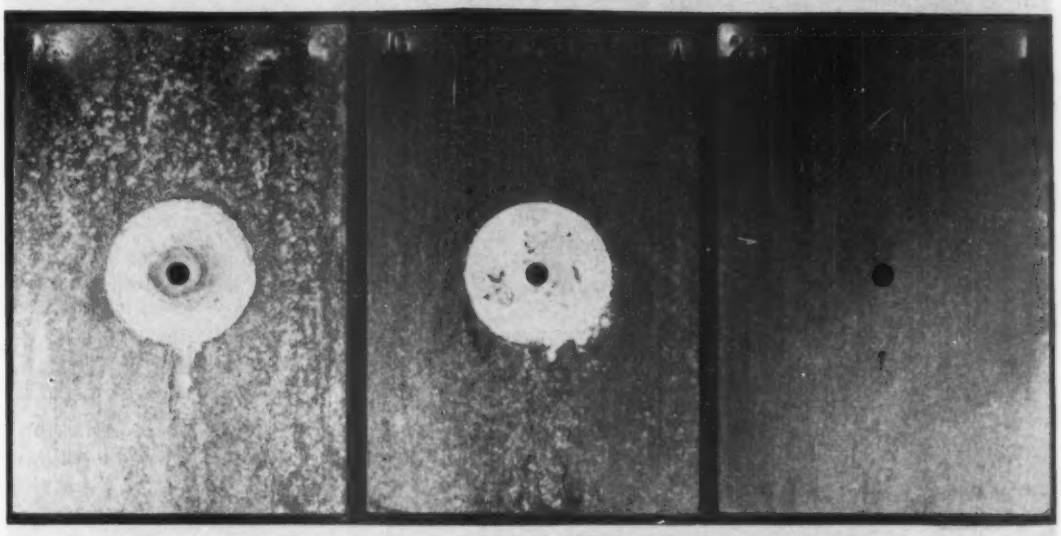


Fig. 8.
Titanium Disc.

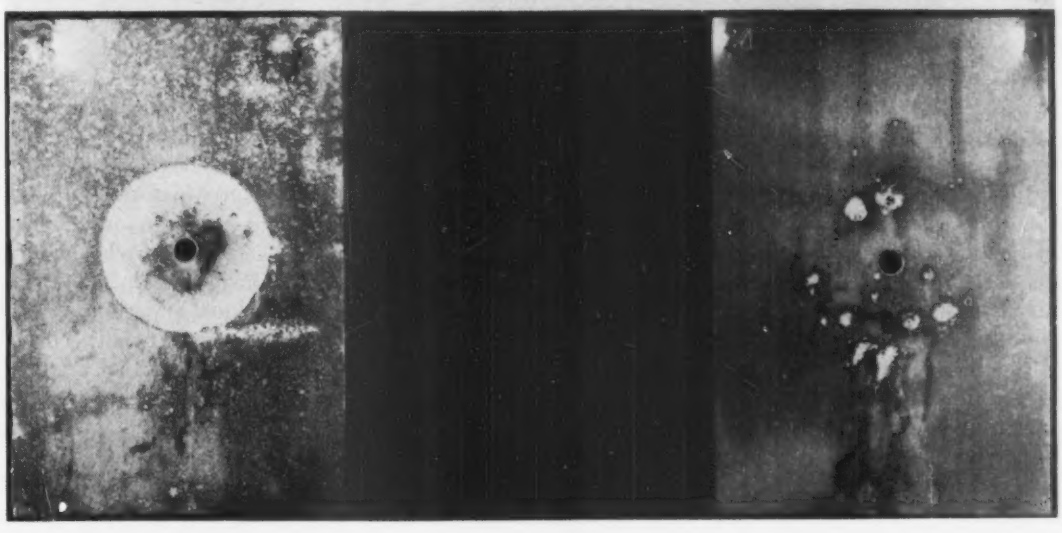


Fig. 9.
Stainless Steel Disc.

TABLE I

Corrosion of Bare Aluminum Panels after 600 Hours' Salt Spray Exposure

Attached Disc	Weight Loss of Aluminum (mg) Total	Due to Corrosion	Average	Due to Galvanic Corrosion
Polystyrene	585	579		
"	613	607	565	0
"	516	510		
Copper	1390	1384		
"	1423	1417	1314	749
"	1147	1141		
Cadmium plated copper	466	460		
"	337	331	392	—173
"	392	386		
Steel	926	920		
"	776	770	875	310
"	942	936		
Cadmium plated steel	440	434		
"	410	404	414	—151
"	411	405		
Tin plated copper	622	616		
" " "	444	438	590	25
" " "	722	716		
Nickel plated steel	588	582	.....	576
Titanium	652	646	.....	640
Stainless steel	769	763	.....	757

Control* Specimen No.	Weight Loss (Mg.)
1	7
2	9
3	3
Average —	6

*Panels not exposed to salt spray for control of aluminum weight losses due to brushing and stripping operation.

TABLE II

Corrosion after 600 Hours' Salt Spray Exposure of Aluminum Panels Anodized 15 Minutes, Not Sealed

Attached Disc	Weight Loss of Aluminum (mg) Total	Due to Corrosion
Polystyrene	314	50
"	286	22
Copper	1176	912
"	1322	1058
Cadmium plated copper	**	**
"	273	9
Steel	711	447
"	461	197
Cadmium plated steel	304	40
"	277	13
Tin plated copper	387	123
"	334	70
Nickel plated steel	446	182
Titanium	463	199

Control* Specimen No.	Weight Loss (mg.)
1	283
2	241
3	267
4	263
Average	264

*Panels not exposed to salt spray for control of aluminum weight losses due to stripping-brushing operation and anodizing.

**Panel improperly anodized.

After 336 hours a cadmium-plated copper disc attached to a bare aluminum panel was corroded to the base metal. The anodized panels to which bare copper discs were attached had holes corroded through the panel along the junction. The weights of aluminum oxidized under the test conditions after 600 hours exposure are shown in Tables I, II, and III. Figures 1 through 9 show representative panels after stripping.

The panels which had copper discs attached were all badly corroded. The attack at the junction was most severe with the anodized-sealed panels while the corrosion of the bare panels was extensive rather than intensive. The panels anodized 15 minutes and unsealed displayed partial distribution of corrosion, as evidenced by large pits over the panel areas, and were not as severely corroded at the junction as the panels anodized and sealed (Figure 2).

The loss in weight of bare aluminum in contact with cadmium was even less than the loss with the corrosion control panels where no galvanic action occurred. Cadmium, therefore, is anodic to 24S aluminum, the former being sacrificially attacked. This fact is further borne out by examination of panels of bare aluminum which had been in contact with cadmium plated discs (Figures 3 and 5). The aluminum adjacent to the discs was not as severely corroded as the equivalent area on the control panels. All of the cadmium plated discs on bare aluminum were corroded to the extent that a large part of the area was devoid of cadmium. An average of about 40 per cent of the disc area had base metal exposed. The cadmium plated discs attached to anodized panels had small areas of base metal exposed, averaging about 3 per cent.

There was considerable galvanic corrosion of aluminum when panels were in contact with steel. The steel discs were badly rusted.

The corrosion of aluminum was only slightly increased by the presence of tin. The tin plated discs, though dull and discolored, did not seem to have undergone significant attack.

Nickel, titanium, and stainless steel resulted in the aluminum being sacrificially corroded except where titanium was coupled to an anodized-sealed panel, in which case the aluminum was unattacked (Figure 8). The galvanic corrosion of aluminum in contact with nickel, titanium, and stainless steel was not sufficiently tested to permit more extensive comment.

Average weight losses of anodized-unsealed panels are not given in Table II because of the variability of results.

TABLE III

Corrosion after 600 Hours' Salt Spray Exposure of Aluminum Panels Anodized 30 Minutes, Chromate Sealed

Weight Control Group No.	Attached Disc	Weight Loss of Aluminum (mg) Total	Due to Corrosion	Average	Due to Galvanic Corrosion
1	Polystyrene	420	8		
2	"	416	—5	—1	0
4	"	367	—5		
1	Copper	1244	832		
2	"	1080	659	767	768
3	"	1206	811		
1	Cadmium plated copper	422	10		
2	"	420	—1	7	8
3	"	406	11		
1	Steel	437	25		
2	"	415	—6	27	28
3	"	458	63		
1	Cadmium plated steel	421	9		
4	"	383	11	5	6
3	"	389	—6		
4	Tin plated copper	385	13		
2	"	430	9	10	11
3	"	402	7		
3	Nickel plated steel	460	65	....	66
1	Titanium	411	—1	....	0
2	Stainless steel	560	139	....	140

Control* Group No.	Weight Loss (mg) Panel	Average
1a	407	412
1b	416	
2a	422	421
2b	420	
3a	395	395
3b	395	
4a	372	372
4b	372	

*Panels not exposed to salt spray for control of aluminum weight losses due to stripping-brushing operation and anodizing.

Conclusions

Under conditions of the salt spray, copper in contact with either anodized or bare aluminum causes rapid and severe corrosion of the aluminum. The corrosion of aluminum in contact with steel discs is considerable but not as pronounced as in the case of copper.

Tin or cadmium plate can be used in contact with anodized 24S aluminum with little or no adverse effect.

Cadmium is slightly anodic, tin is slightly cathodic, and steel and copper are increasingly cathodic to 24S aluminum.

The author wishes to thank the Ordnance Corps for permission to publish this material.

STRESS IN ELECTRODEPOSITED COATINGS — ITS SIGNIFICANCE AND MEASUREMENT

(*Concluded from page 51*)

though the cyclic stress which causes it is far below the strength of the metal. The basic mechanism of most fatigue failure is that, sooner or later at surface flaws, minute cracks develop which grow and propagate under the repeated stress until failure results. Fatigue failures may also result from the growth of cracks around interior flaws but, in the majority of cases, cracks develop on the surface and work their way inwards. Fatigue strength is an important consideration in any part that may be subject to periodic stress, such as in machines and engines, and it is of vital importance in the aircraft industry where life and death may hinge on the premature failure of a part.

Stress in electroplated coatings is an important practical factor in some of these applications because, in general, when an external stress is applied to an object which has an internal or residual stress, the total stress is increased or diminished algebraically. Thus, in the vibrating part shown in Fig. 9, there is

Fig. 9. Effect of alternating stress of 30,000 psi on nickel deposit with a residual stress of 30,000 psi.

an alternating stress of plus or minus 30,000 psi. If the part is coated with a nickel plate in which the stress is 30,000 psi then, on the positive part of the cycle, the total tensile stress in the nickel plate would be 60,000 psi. On the reverse part of the cycle the total stress in the nickel would be 0. A stress of 60,000 psi is above the tensile strength of the nickel deposit and the underlying metal and, as a result, cracks will develop which will go clear through the nickel deposit and into the surface of the part. Once this occurs, the cracks will grow deeper and deeper as the stresses repeat until, finally, sudden failure results. Tests made of fatigue life on steel parts plated with highly stressed nickel, have shown that, in some cases, as much as a 40% reduction in fatigue strength results from plating these parts with highly stressed nickel or chromium. To mention the other side of the coin, deposits which are compressive in nature when applied to steel, may increase the fatigue strength by as much as 7%. This, no doubt, is due to the fact that cracks cannot propagate in a compressively stressed surface.

We have now considered in some detail the significance of stress to the plater. The next part of this paper will deal with some of the suggested causes of stress and methods for measuring it in electrodeposits.

Some Tips on Electroforming

By Marv Rubinstein, *Metal Finishing Consultant, New York, N. Y.*

This completes the three-part series, which started in the February issue.—Ed.

Some Typical Operations

Unfortunately, in a paper of this length, it is not possible to give a detailed description of all the specific operations required for the many applications of electrofabrication. However, the writer feels that a description of a few typical applications in practice will give the reader a better feel for the subject.

PHONOGRAPH RECORD MATRICES:

The original recording is cut on a lacquered aluminum disc. The disc is lightly cleaned with soap bark or other mild cleaners using a soft camels hair brush. It is then made conductive, usually by the application of a silver nitrate solution, reduced by sugar or formaldehyde. The conductive disc is then nickel plated in a special bath for 30 minutes at about 5 amp./ft.^{2} followed by a 15 minute flash in a low-concentration acid copper at 20 amp./ft.^{2} The disc is now ready for the electrofabricating operation. This is done in a high-speed acid copper bath using cathode rotation and solution circulation at speeds as high as 0.001 inch in 10 minutes. After depositing 0.025″-0.030″ copper, the electrofabricated metal "master" is then separated from the original recorded disc.

From this plate, which is an exact reverse duplicate of the original recording, all subsequent plates are made. The master is cleaned, lightly polished, and given a 5 second dip in a dichromate parting solution, to give it a separating film. It is then given the same plating treatment as was given the silvered lacquered-disc, i.e. nickel plate, copper flash and copper build-up. By flexing it with the hands, this new metal part, the "mother," is separated from the master plate. Both master and mother are kept in storage, but from the mother another group of plates known as "stampers" are made using the same process. These stampers are given a subsequent chromium plate, back turned on a lathe using a vacuum chuck, trimmed to size and given a finish polish. They are in structure just like the master but, while the master is stored away for safe-keeping, the stampers are used as the dies with which commercial phonograph records are pressed from soft plastic materials.

EMBOSSING PLATES:

Embossing plates are flat molds made to reproduce the exact grain of leather, plastic, or cloth in making plastic articles. The skin or cloth is first prepared for use by coating the back with an oil-free asphaltum varnish, stretching and allowing to dry. The skin is then mounted on a flat sheet of copper, allowing about a one inch margin. The mounting is done, using molten ozokerite wax as a binder, allowing the wax to grip both the skin and the copper plate as it hardens. Now, using a fine camels hair brush, the surface of the skin is varnished with a dilute solution of rubber cement. This acts as a filler, taking about two hours to dry completely.

The skin is now ready for a conductive coating. Many shops still use several layers of polishing graphite and/or molding graphite for this purpose. This is also applied with a fine brush, taking care that no detail is destroyed by leaving too thick a coating at any point, but making sure that all areas are covered.

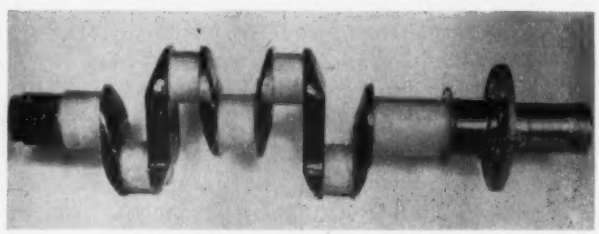
Before plating, two more steps must follow. Copper wire contacts are arranged at several points around the border of the skin. Next, immerse the skin in a solution of copper sulfate and sulfuric acid, and sprinkle finely divided iron powder over the surface. This will give an initial immersion coating of copper over the graphite and help insure complete coverage.

The mounted skin is now given a two hour strike in a low-concentration acid copper bath at about 2 volts and 10 amp./ft.^{2} After inspecting for complete coverage, the plate is placed in the high speed acid copper bath and plated at 40 amp./ft.^{2} until a thickness of about 0.125″ is obtained.

The metal negative is now separated from the original skin, trimmed and sweated to a rigid steel plate. This negative embossing plate may then be used either directly for reproducing "synthetic skins" or as an intermediate plate in preparing additional negatives by means similar to those used in making phonograph record matrices.

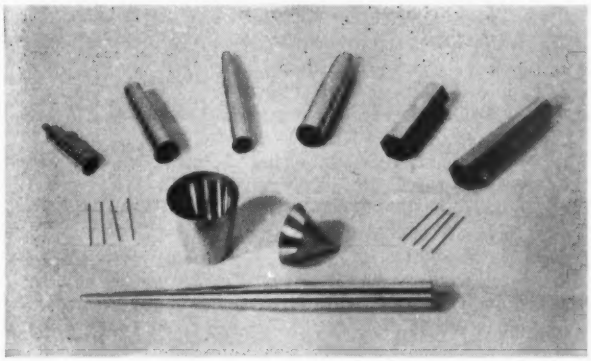
DIAMOND DRILLS:

High quality diamond drills, dental drills, and simi-



(Courtesy International Nickel Co., Inc., New York)

Fig 9. Crankshaft with worn bearing surfaces salvaged through electrofabrication. Other areas were stopped-off, and 0.01″ nickel was deposited on the remachined bearing surfaces. A final machining or grinding completes the job.



(From "Practical Nickel Plating;" courtesy Camin Laboratories, New York)

Fig. 10. A number of difficult shapes now being manufactured automatically, utilizing electrofabricating techniques. These include fountain pen caps and hypodermic needles.

lar abrasive tools are often electrofabricated, using nickel plate as a matrix or binder for the diamond powder. This operation is usually carried out in small baths ranging from one to five gallons. A similar process is used on a larger scale to hold silicon carbide to the surface of slip-free stairways used on naval vessels. Though a variety of methods exist, the following one is fairly typical.

A number of carrier bodies on mandrels are machined from steel or brass to the desired dimensions. An indentation may be made to allow for the build-up of the nickel-diamond matrix. These tool bodies are placed in a rack and stopped-off, so that only the area to be covered with diamond powder is exposed. The parts are then degreased, electrocleaned and given a copper flash. In some cases, a reverse-current acid etch is used instead of the copper. The rack of parts is then transferred to a nickel chloride plating bath(. with the surface to be coated facing upwards. Chloride baths are generally preferred, since the presence of diamond powder in a bath tends to encourage treeing, a phenomenon less evident in chloride baths than in the Watts type solution.

The diamond powder (usually about 120 mesh) may be sprinkled from a salt shaker into the bath during nickel deposition and allowed to fall on the parts. More usually, however, the diamond powder is suspended in the bath. When the rack of parts is inserted, it is first used to agitate the bath and shake up these suspended particles. The rack is then clamped in position and, while the diamond powder is slowly falling onto the uppermost surface of the tool, a current of 10 to 20 amp./ft.^{2} is passed. The parts are plated this way for about 2 hours. Then, the rack is agitated once more, partially to stir up the diamond powder again and partially to shake-off from the tool surface loose or weakly attached particles. Plating is resumed for another one or two hours, and then the procedure is again repeated.

These steps — plating and agitating, plating and agitating — are repeated as often as is necessary to obtain the desired thickness of plate. Where several surfaces must be coated, it may be necessary to rotate the rack periodically during the plating operation. Then the parts are removed from the bath, cleaned and dried. They are then heat treated in an oil bath for 1 hour at 350 to 400°F. to remove hydrogen embrittlement. The finished tool has electrofabricated on its surface a matrix consisting of approximately $\frac{1}{3}$ by volume diamond powder and the remaining $\frac{2}{3}$ nickel.

INJECTION MOLDS:

Since injection molding utilizes high pressures at rapidly changing temperatures, electrofabricated molds for this purpose must be thicker and tougher than other types of molds, and must be practically free of internal stresses. Consequently, hard nickel must be the base material for these molds.

To start the process, a positive master is made by machining, casting, hobbing, etc. It is decided just where the parting line of the die should be, and this master is sunk into a plastic material so as to leave only the section on one side of the parting line exposed. The part is now mounted on a plating rack. This rack should be so designed as to provide the best current distribution for the particular mold being produced, utilizing methods suggested earlier in this article. Inside anodes should be used where needed.

Next, the article and surrounding plastic are made conductive, usually by reduction of a silver solution to form a silver film on the surface. Part of this film may then be cut away so as to limit the conductive area to the positive itself plus a small border area on the mounting material. The positive is now ready for nickel plating.

One of the hard (above 450 Vickers) nickel baths is used, either the sulfamate, the fluoborate or the Watts bath with a stress reducer. Before plating the mold, the bath must be tested both for stress and for ductility. The former is determined with a contractometer or a stresometer, while ductility is roughly approximated by plating a thin strip to a predetermined thickness and bending it back and forth so see whether cracking occurs at the bend. If the bath is in order, the mold positive is nickel plated. Though some of these baths will operate as high as 150 amp./ft.^{2}, it is usually wiser to start at considerably lower than this figure to insure optimum levelling. From $\frac{1}{8}$ to $\frac{1}{4}$ inch of nickel is deposited. This may require as much as two weeks time in some plants. The plating should be inspected at least once every 24 hours, and excess build up should be ground off where necessary. The current may slowly be increased on succeeding days. Stress, etc. should also be regularly checked.

After removing from the nickel tank, the part is rinsed and given a further build-up in a periodic reverse cyanide copper bath. This type of bath is utilized to help level off the back of the mold as much as possible. Consequently, a higher sacrificial PR cycle is used to start. The resulting copper should have a hardness of 250 Vickers (or more), and the total thickness of nickel plus copper should be from $\frac{1}{2}$ to $\frac{3}{4}$ inch. This may require an additional week or ten days in the copper bath, including periodic inspection, of course.

When the required thickness is achieved, the part is removed. The mold is then separated from the positive, cleaned and dried. It is then placed in a lathe or shaper, and the back and sides are machined down so as to give the mold cavity a regular external shape

— either circular or rectangular. A number of these cavities are then mounted in a steel bolster having openings just big enough to hold these molds. The cavities are fastened in the bolster by means of countersunk screws. Where a number of cavities are required from a single master, this mold may be filled with a low melting point metal to make as many new positives as are required. These positives are then used to electrofabricate the desired number of mold cavities.

RESIZING WORN COMPONENTS:

The worn component, e.g. a shaft, is placed in a lathe, and enough of the worn surface is removed to bring the diameter down to that of the section having the deepest score marks. If only a small section of the shaft is scored, only this section is machined down, making sure however that the points where the machining begins and ends are not sharp but involve a gradual reduction in diameter. Parts where plating is not required are stopped-off with tape or lacquer.

Here again a careful racking job is required. If the part is a shaft, for example, the surrounding anodes should be arranged in a concentric circle or as close to this as possible. Current thieves may be required at one or both ends. Good, solid rack members capable of handling high current densities should be used.

The shaft is then degreased and electrocleaned. This is always followed by a reverse current etch in either sulfuric acid (20 to 50 per cent) or chromic acid. (Where the build-up is in chromium, the same bath may be used, utilizing a reversing switch.) The etching time will vary with the basis metal, running from ½ to 10 minutes. Six volts is required. Following this, the part is given a quick rinse and transferred to the plating bath.

Resizing may be done in either chromium, nickel, iron, occasionally copper, or any laminated deposit of two or more of these. It is not recommended that chromium deposits of more than 0.010″ be attempted. In fact, even where as much as 0.005″ or more of a very hard deposit is required, the writer suggests building-up with hard nickel and finishing the last 0.002″ with a chromium plate.

Plating solutions used in resizing operations should always be carefully controlled, as should voltage, current density, and time of deposition. In all except chromium plating, the part should be inspected from time to time while plating. For some operations, a regular check on stress should also be made.

Taking excess build-up on edges into consideration, plating should continue until about 20% more thickness has been plated than is required. Where 0.005″ is needed, for example, 0.006″ should be plated. When completed, the part is removed from the bath and remachined down to the required diameter. (For chromium and the hardest nickels, grinding may be necessary.) Where nickel plus chromium is used, the part must be machined and etched once more between the nickel and the chromium plating operations.

Many parts are stress relieved in a hot oil bath after the plating operation. This is particularly true of parts resized with chromium.

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Finishing Pointers

The Use of Pilot Lights

By J. B. Mohler

AN electroplating process is sufficiently expensive that a few dollars spent on control and indicating equipment is money well spent. In terms of the cost of a simple plating line the cost of controls may not seem justified. However, in terms of hours of labor lost in case of trouble, the cost of such equipment is low.

The ideal control panel should tell the plater if all of his equipment is operating correctly merely by an occasional glance. If it is necessary to make a check with a hand instrument, the checks will not be made often enough. Even when a temperature indicator is available on a tank, it often takes hours before one realizes that the bath is not up to temperature because the heaters are not working.

The cost of heaters, thermostatic control and a temperature indicator is sufficient that the cost of pilot lights on the heaters is justified to complete the controlling and indicating equipment. Such pilot lights are often placed across the terminals of the heaters. This will show if current is available at this point and is a good investment. However, it will not show if the heaters blow out since the pilot lights are in parallel with the heaters and will continue to burn even though the wires in the heaters have broken or corroded. A pilot light in series with the heaters will correct this situation.

In order to use a pilot light in series with an electric heater it is necessary to place a resistance in series with the heater to obtain enough voltage to light the lamp. This will result in some loss of heating capacity, but it can be done by use of as little as 1% of the total capacity.

In order to use as little of the voltage as possible to operate the light assume that 2 volts is desired. If a 5000 watt heater is operated at 220 volts,

$$I = \frac{W}{E} = \frac{5000}{220} = 22.7 \text{ amps.}$$

$$R = \frac{E}{I} = \frac{220}{22.7} = 9.7 \text{ ohms}$$

The resistance required is:

$$\frac{2}{220} \times 9.7 = 0.088 \text{ ohms}$$

The wattage of the resistance is:

$$2 \times 22.7 = 45.4 \text{ watts minimum}$$

From a catalog of resistances a fixed resistance or a resistance with an adjustable contact is selected at 0.088 maximum ohms and 45 minimum watts.

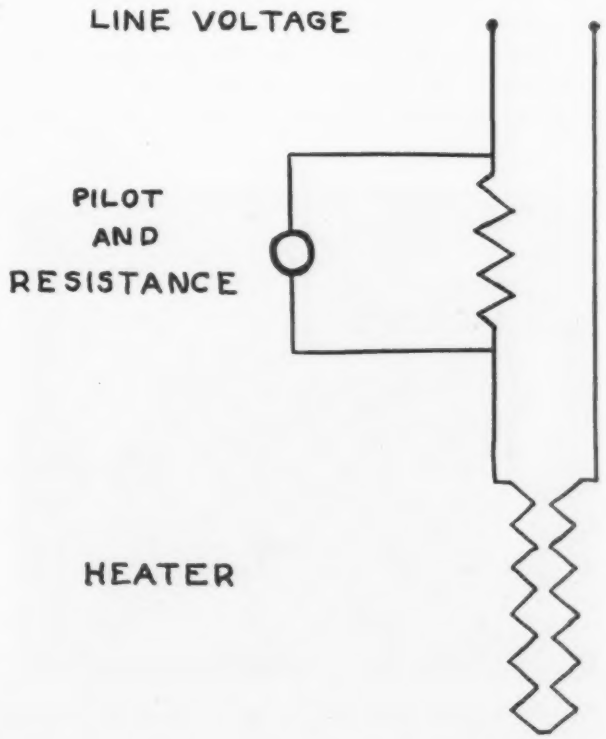
The wattage capacity should be sufficiently high to avoid overheating. If the exact resistance cannot be obtained a little lower resistance may be used. The lower the resistance the less the voltage drop, since it will be a smaller percentage of the total. The lower the operating voltage of the lamp the longer the lamp life, which is important. A 2 volt lamp operated at 2½ volts will be brighter at the expense of frequent replacement of lamps. A 2 volt lamp will still be bright enough to be seen at 1½ volts. This however should not be carried to an extreme. If the lamp is operated at too low a voltage and is covered with a colored glass in a bright room it may be difficult to tell whether or not it is burning.

Pilot lights should be considered as permanent equipment and be placed on a panel board where they can be readily observed. A good position is directly behind the plating tank or in a position where the plater will spend considerable time during his work.

Thermostats and automatic tank control equipment for level, temperature and cooling control often come with pilot lights that are easy to observe.

If a thermostat is installed that does not have a pilot light or, if a pilot light is in a position that it cannot easily be seen, it is worth while to make a remote connection so that the pilot light can be installed on the panel board.

By the use of pilot lights it is easier for the plater to assume the responsibility for operation of the line. If he can tell at a glance that his equipment is operating and his temperatures are up, he will assume that responsibility. It also emphasizes the importance of control. If control is of sufficient importance to justify



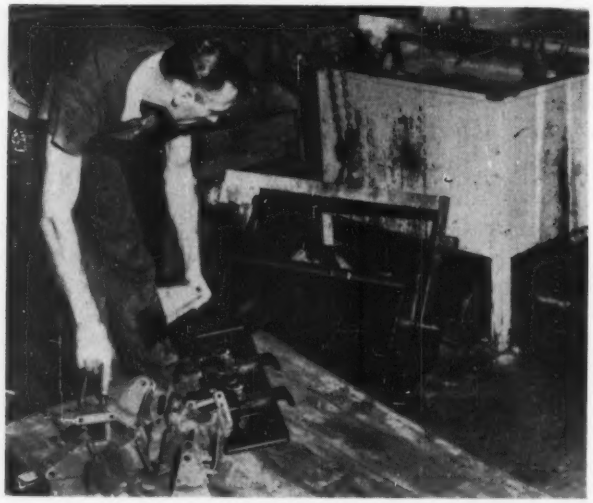
the installation of automatic equipment as well as visual indication of control then it is likely that any indication of failure will be observed and quickly reported.

The benefits to be gained by the use of indicating equipment are worth the cost of such equipment. Also they are worth the time it takes for design. It is not always possible to buy custom built controlling and indicating equipment for each case. The variations in the plating processes and the layout of a plating line are such that, frequently, it is necessary to design for the use of standard relays, lamps, switches, and resistances. These components can be used to design for convenience of observation. The easiest place to change a plating line is while it is still on the drawing board. And the easiest place to plan for space and equipment to provide economic facilities of operation is also on the drawing board. Preliminary engineering of proper details means the saving of hours of time in the production stage.

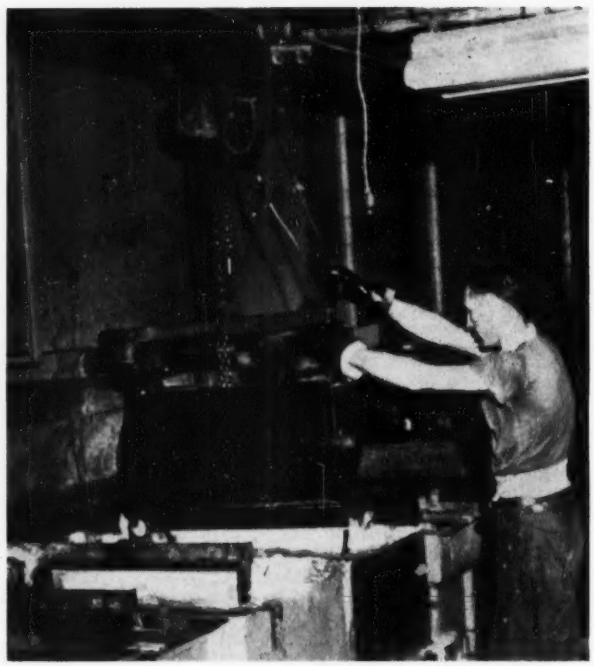
BLACK OXIDE COATING

Barrel Line Saves 50% Over Baskets

SAVINGS of up to 50 per cent in operating costs in forming black oxide on steel caster parts have been achieved by the *Colson Corporation*, Elyria, Ohio, through the design of a barrel line for the chemical plating process.



Worker loads caster forks into barrel of new black oxide plating unit.



Barrel of caster forks going through black oxide plating process is lowered into one of six tanks used in process. An electric chain hoist moves the barrels from tank to tank. In the tanks the barrels, which have sides of perforated, heavy gauge sheet steel, are rotated, facilitating complete coverage of the parts being processed.

Work formerly requiring 80 hours, now is accomplished in 16 hours. The new method also achieves an upgraded product, and has obviated an inspection station. Colson manufactures casters and material handling equipment.

Under the former method the firm coated steel surfaces by transferring baskets loaded with work from tank to tank. Neither the work nor solution were agitated and the result was a non-uniform coverage of the steel parts. Often a repeat treatment was needed.

In turning to a barrel line operation, Colson selected steel as the barrel material because hot caustic soda is used in the process. No standard barrels were available so the company designed a hexagon shaped barrel which is 27 inches long and 15 inches between the sides of the hexagon. The body of the barrel is made of perforated heavy gauge sheet steel. A drive unit rotates the barrel at 2.5 r.p.m., a speed which gives excellent coverage of parts without nicking.

The barrel is hung by heavy steel hanger brackets at both ends, with a projection of tubing on these brackets acting as a lug to engage a channel guide and align the barrel to the guide. The six tanks used in the process are of unlined steel and are 24 x 24 x 36 inches. Continuous operation is maintained with five barrels. Work is placed in the barrel to seven-eighths full. An electric chain hoist moves the barrels from tank to tank.

An important criterion of the work is maintenance of proper temperature control in the two tanks containing the blackening salts. As the salt solution evaporates and becomes more concentrated, the boiling point rises. When it rises above a control temperature, a controller signal automatically opens a motorized water inlet valve. This remains open until the boiling point has returned to the control temperature.

Science for Electroplaters

13. Hydrolysis

By L. Serota

THE ionization of water, although exceedingly slight (1 mole in ten million liters), is of considerable importance because interaction between these ions and the ions of a dissolved salt is possible. Solutions of salts like sodium carbonate and potassium cyanide, for example, will not react neutral but, instead, will exhibit alkaline properties (pH greater than 7), whereas such salts as copper sulfate and nickel chloride when dissolved in water will have an acid reaction (pH less than 7). A solution of sodium chloride, however, will be approximately neutral.

Such changes can be better understood by considering the case of potassium cyanide. This salt in solution will ionize, yielding the potassium ion, K^+, and the cyanide ion, CN^-. Since the hydrogen ions, H^+, and hydroxyl ions, OH^-, are also present due to the ionization of water, the interaction that is possible may be represented by the following equation:

$$K^+ + CN^- + H^+ + OH^- \rightarrow HCN \text{ (very slightly ionized)} + K^+ + OH^-$$

Since hydrocyanic acid, HCN, is a very weak acid, the hydrogen ion unites with the cyanide ion to form the undissociated (unionized) molecules of HCN. Removal of the hydrogen ions in this process will continue until an equilibrium is established between the slightly ionized hydrocyanic acid yielding the ions H^+ and CN^- and the unionized molecules HCN. $HCN \rightleftharpoons H^+ + CN^-$. Removal of the hydrogen ions means further dissociation of water, since the ionization constant for water, $[H^+] \times [OH^-] = K_w$, must be maintained. The solution therefore acquires an excess of hydroxyl ions, OH^-, resulting in an alkaline reaction. Since potassium hydroxide is a strong base (alkali) the ions K^+ and OH^- can exist in a free state in solution in the presence of each other.

The interaction described between the ions of the salt and the ions of water, resulting in the formation of a free acid and free alkali, is called hydrolysis or hydrolytic dissociation. As previously stated, salts are the products of neutralization. When the salt is formed by a weak acid and a strong base, like potassium cyanide, the solution will give an alkaline reaction: that is, the pH value will be greater than 7. The salts of the alkali metals, such as the cyanides, carbonates, silicates, borates, phosphates, pyrophosphates, and acetates, are alkaline in solution. The strong bases in aqueous solutions are KOH, NaOH, $Ca(OH)_2$, $Ba(OH)_2$. Salts used in alkaline cleaning baths, such as sodium carbonate, Na_2CO_3, trisodium phosphate, Na_3PO_4, tetra sodium pyrophosphate, $Na_4P_2O_7$, sodium hexametaphosphate, $(NaPO_3)_6$, and sodium metasilicate, Na_2SiO_3, hydrolyze in solution and give this typical alkaline reaction:

$$Na_3PO_4 + H_2O \rightarrow Na_2HPO_4 + NaOH$$
$$Na_2SiO_3 + 2H_2O \rightarrow H_2SiO_3 + 2NaOH$$
$$Na_2CO_3 + H_2O \rightarrow NaHCO_3 + NaOH$$

Hydrolysis in Plating

The hydrolytic action of sodium silicates in metal cleaning was discussed by McMullen and Ozar in the April 1949 issue of METAL FINISHING. Solutions of sodium metasilicate, it was concluded, undergo both hydrolytic and ionic dissociation, giving rise to positively charged sodium ions, Na^+, negatively charged hydroxyl ions, OH^-, silicate ions, $SiO_3^=$, and metasilicic acid, H_2SiO_3, most of the latter being crystalloidal rather than colloidal. The alkaline silicates, the authors conclude, possess a high detergent potential and deserve wide application in the metal cleaning field.

The loss of cyanides from aqueous solutions may be attributed, according to Meyer, Muraca and Serfass in the October 1952 issue of PLATING, to mechanical factors such as dragout, spray and chemical changes. Some of the chemical changes resulting in the formation of hydrocyanic acid, HCN, ammonia, NH_3, and sodium (or potassium) formate, HCOONa, are caused by hydrolysis of the alkaline salt. The equation for the formation of hydrocyanic acid may be represented as follows:

$$NaCN + HOH \rightarrow NaOH + HCN \quad (pH \text{ is about } 12)$$
$$\text{or } CN^- + H_2O \rightarrow HCN + OH^-$$

This hydrolytic action, whereby HCN is formed, accounts for the odor of this gas over a freshly prepared tank. Removal of the gaseous HCN will disturb the equilibrium of the above equation and cause decomposition of the alkali cyanide. Such decomposition necessitates frequent analysis of cyanide baths so that the required concentrations will not be appreciably altered. If air, containing carbon dioxide, CO_2, is bubbled through the solution for the removal of HCN, decomposition occurs according to the following reaction:

$$NaCN + H_2O + CO_2 \rightarrow NaHCO_3 + HCN$$

The use of NaOH in such baths is to provide assurance that the hydroxyl ion concentration will not be lowered in this reaction, thereby reducing the possible decomposition of the alkali cyanide. Actually, carbon dioxide forms carbonic acid, H_2CO_3, so that, with NaOH present, sodium carbonate forms according to the following equation:

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$

Sodium hydroxide will also react with any sodium bicarbonate in the tank, changing it to sodium carbonate:

$$NaOH + NaHCO_3 \rightarrow Na_2CO_3 + H_2O$$

Another chemical change occurring in the cyanide tank due to hydrolysis results in the formation of ammonia and sodium formate:

$$NaCN + 2H_2O \rightleftharpoons NH_3 + HCOONa$$

This reaction, which could result in complete decomposition of the cyanide solution, does not proceed very rapidly, a fortunate factor in the use of this type of solution. The authors do suggest, however, that speeding up this reaction with a suitable catalyst could serve as an effective method for the elimination of waste cyanide solutions.

The rate of decomposition of cyanide solutions due to hydrolysis and absorption of carbon dioxide is appreciably reduced by the addition of sodium hydroxide. An increase in the concentration of the hydroxide ion represses the hydrolytic action by a shift in the equilibrium from right to left: $CN^- + H_2O \rightleftharpoons HCN + OH^-$. It was shown for example, that a dilute solution of sodium cyanide (5 g./l.), when kept in an uncovered beaker at

70°F. for one week, was decomposed more than 90 per cent; whereas a solution containing sodium cyanide 5 g./l. and sodium hydroxide 40 g./l. under the same conditions showed only a 5 per cent decomposition. These results lead to the recommendation that decomposition in cyanide dipping solutions, especially dilute solutions, can be reduced considerably by including some free alkali. For a solution containing 1-2 oz./gal. of sodium cyanide, it is suggested that a minimum of 4 oz./gal. of sodium hydroxide should be present.

Acid Solutions

When the salt is formed by a strong acid and a weak base, e.g., ferric sulfate, the aqueous solution will give an acid reaction; that is, the pH value will be less than 7. Hydrolysis occurs according to the following reaction:

$$Fe_2(SO_4)_3 + 6H_2O \rightarrow 2\,Fe(OH)_3 + 3H_2SO_4$$

Since the ferric hydroxide is a weak base, the ferric ion Fe^{+++} will unite with the hydroxide ion OH^- to form the undissociated molecule $Fe(OH)_3$. The solution thus acquires an excess of hydrogen ions, resulting in an acid reaction. The common strong acids in aqueous solution are nitric, HNO_3, sulfuric, H_2SO_4, and the hydrohalogens like HCl, with the exception of hydrofluoric, HF.

The acidity of such salts may be assumed to be due to the acid properties of hydrated heavy metal ions such as $Fe(H_2O)_6^{+++}$ or $Cu(H_2O)_4^{++}$. The ion reacts with the water to form the hydronium ion H_3O^+, with the metal ion coordinated with the hydroxyl ions. Hydrated cations of heavy metals usually combine with six or four molecules of water (coordinate covalence). The equations representing this hydrolytic equilibrium are as follows:

$$[Fe^{+++}(H_2O)_6] + H_2O \rightleftharpoons [Fe^{++}(H_2O)_5OH] + H_3O^+$$

$$[Cu^{++}(H_2O)_4] + H_2O \rightleftharpoons [Cu^{+}(H_2O)_3OH] + H_3O^+$$

or

$$[M(H_2O)_m^{+}] + H_2O \rightleftharpoons [M(H_2O)_{m-1}OH] + H_3O^+$$

where $M(H_2O)_{m-1}(OH)$ represents the weak base.

Hydrolytic Precipitation

The cations of many of the heavy metals yield weak bases upon hydrolysis. Since many of these hydroxides are slightly soluble, precipitation as hydroxides or basic salts occurs. The pH at which precipitation starts will depend upon the basic nature of the base. The pH at which such hydrolytic precipitation will take place for some common metal ions is shown in Fig. 35. The chart shows that precipitation of the hydroxide of the ferric ion Fe^{+++} occurs at a lower pH than does the hydroxide of the ferrous ion. For that reason it is advisable to oxidize the iron that may be present in solution in a nickel tank to the ferric state. It will also be noted that copper, if present in a nickel tank, will hydrolyze and precipitate as the hydroxide at a lower pH than nickel hydroxide, which precipitates at a pH in the region of 6.5.

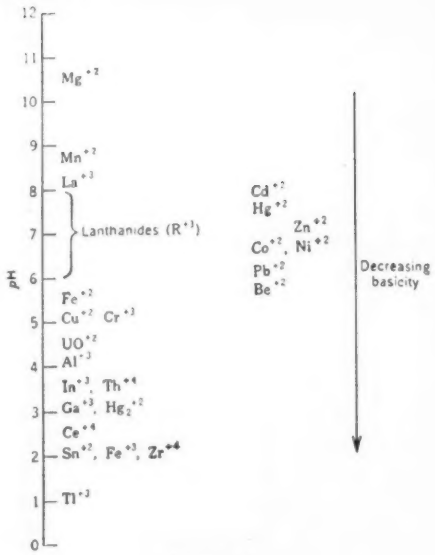


Figure 35.

In the acid tin bath, the stannous sulfate, $SnSO_4$ will oxidize to stannic sulfate $Sn(SO_4)_2$ which shows a tendency to hydrolyze unless the bath is strongly acid, yielding the precipitate stannic hydroxide $Sn(OH)_4$:

$$Sn(SO_4)_2 + 4H_2O \rightarrow Sn(OH)_4 + 2H_2SO_4$$

Rate of Hydrolysis

The effect of hydrolysis upon addition agents used to produce leveling in acid copper baths was discussed by Nobel and Ostrow in the August 1954 issue of PLATING. Thiourea, for example, in a fresh solution plated brighter and showed better leveling than solutions that had been standing for a while. The dullness of the deposit seemed to increase as the solution stood for a long time, and signs of roughness appeared. This is due to the hydrolyzing action of thiourea, which breaks down into ammonia, NH_3, carbon dioxide, CO_2, and hydrogen sulfide, H_2S:

$$NH_2CSNH_2 + 2H_2O \rightarrow 2NH_3 + CO_2 + H_2S$$

The importance of an understanding of the rate of this hydrolysis as well as the possible effect of the products of decomposition upon the deposit was stressed. The authors report, as an example, the addition agent dicyandiamide, which exhibits excellent brightening action in an acid copper bath but is not satisfactory because it hydrolyzes rapidly, yielding harmful products. Nitriles and other cyanogen compounds in this class give excellent results but cannot be considered because of this hydrolytic action or breakdown in the plating solution.

The preparation of nickel sulfamate for use in a nickel sulfamate plating bath requires the presence of a suitable inhibitor and controlled reaction techniques to avoid the breakdown of the salt due to hydroysis. In a report of this bath, Barrett cited this condition and referred to the slow hydrolysis of sulfamic acid and its salts, forming ammonium acid sulfate if the temperature of the solution was 80°C. and the pH was low:

$$NH_2SO_3H + HOH \rightarrow NH_4HSO_4$$

Determination of free fluoboric acid and total fluoborate in a lead fluoborate bath will result in inaccurate results due to the hydrolytic action of the acid if the solution is diluted or not freshly made. The reaction representing this hydrolysis is as follows:

$$HBF_4 + H_2O \rightarrow HBF_3OH + HF$$

Methods of analysis in which it is believed this error is reduced are published in standard texts.

Salts such as copper sulfate, nickel chloride, zinc sulfate, ferric chloride and certain others cannot be stored in steel containers because of the corrosive action of the free acid formed by hydrolysis.

Buffer Action

Control of pH is an important factor in plating operations. It is significant in the commonly used Watts type nickel bath. For best results in the quality of the deposit, the pH range for a given bath should not show a greater variation than ±0.5 pH and, for bright nickel baths, the recommended pH variable is ±0.3 pH. Changes in pH in the Watts type nickel baths may result from a difference in anode and cathode efficiency, or it may be due to drag in of acid or alkali. To reduce such changes in the plating solution and maintain plating operations within the pH limits specified, buffer agents are introduced. Boric acid, H_3BO_3, for

(*Continued on page* 67)

SHOP PROBLEMS

ABRASIVE METHODS SURFACE TREATMENTS CONTROL
ELECTROPLATING CLEANING PICKLING TESTING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating Over Solder

Question: I am employed by a compact manufacturer, and have difficulty covering up soft solder (63/37) on brass mesh products. Our cleaning and plating cycle runs as follows:

1. Pickle — 10% sulfuric — room temp. Rinse.
2. Bright dip—nitric sulfuric. Rinse.
3. Cyanide dip—room temp. Rinse.
4. Dry in degreaser.
5. Remove excess solder with dry steel brush.
6. Cut and color.
7. Degrease.
8. Electro clean — copper strike — 2 minute nickel plate—gold flash.

Please let us know what we are doing wrong. We would also appreciate it very much if you could supply us with a better cycle, if possible.

J. D.

Answers After electrocleaning and before copper striking, you should acid dip the parts to clean up the solder which films over in the cleaner. For this purpose you can use a 10% by volume solution of muriatic acid or, preferably, a 10% solution of fluoboric acid.

Aside from this, we see nothing wrong with your cycle.

Iridium Baths

Question: We would appreciate any information you can furnish us regarding iridium plating.

E. P. S.

Answer: The only iridium bath in our files is a complex nitrite solution similar to the platinum formulation. We know of no commercial application of the process. However, for further details you can refer to the patent obtained by E. M. Wise (U. S. Pat. 1,970,950. Aug. 21, 1934) and assigned to International Nickel Co., Inc.

Non-Reflecting Chromium Finish

Question: We have a requirement to produce a dull, non-reflective chromium plate for hand tools and the like, such as used on micrometers, etc. The usual "satin" finish is not satisfactory for the purpose since it has too much reflectance, even though diffuse. We have looked in all the publications we can get our hands on, but can find no information on it.

We would, therefore, very much appreciate any information you can give us on the subject. We have the usual cleaning and polishing equipment, use a cyanide copper, bright nickel, cold Watts dull nickel, and 100-1 chromium. We activate the bright nickel in a sodium cyanide — water solution at 6 volts.

J. H. R.

Answer: To produce a dull, non-reflecting chromium surface it is necessary to matte the base. This can be done by etching, abrasive blasting, or tumbling in an abrasive, if the parts are small enough.

A bright nickel undercoat is not suitable for a dull chromium finish, and a dull nickel should be employed. Micrometers are usually chromium plated directly on the steel, which produces the desired lusterless finish. Camera parts are usually wet abrasive blasted if precision machined and tumbled with abrasive stones if not.

Tungsten Plating

Question: Will you please inform us if tungsten is being deposited electrically, and if there is any literature available on the subject.

W. L.

Answer: Although pure tungsten has never been electrodeposited from aqueous solutions, the literature on tungsten alloys containing iron, cobalt and nickel is quite extensive. A section on the subject will be found in the book "Modern Electroplating," edited by Allen G. Gray.

Refinishing Auto Parts

Question: As you are a leader in the field, we refer to you to supply us information on the following problem.

We are rechroming automobile accessories (bumper, grill, etc.) and get complaints about stains. After chrome plating these parts are warm water rinsed and dried in sawdust. Do you know of any last dip, suitable to prevent staining on service?

Auto manufacturers, as we know, are using an organic coating to preserve the chrome finish on their parts. Can you supply us with the kind of coaitng which is used, and who sells it?

G. L. L.

Answer: The staining is probably due to rust coming out of the pores in the deposit. This is common on refinished parts which have been pitted in service, because replating does not cover the pits.

The organic finish used on chromium plated parts is a clear lacquer. These lacquers can be obtained from most suppliers of organic finishes. However, in order to obtain good adhesion, a pretreatment is suggested in a weak solution of chromic acid. Use about 2 oz./gal. at 150-160°F. The articles need not be rinsed before lacquering.

Impact Plating

Question: We would very much appreciate having information and names of material suppliers for a process called Peen Plating to be used for

brass coating an item made from powdered iron.

J. F.

Answer: Our files show that two patents were issued on an impact plating process, whereby a suspension of metal powder in an organic liquid containing a lubricant is tumbled with the parts, resulting in production of an adherent coating.

For further details refer to U. S. Pat. 2,640,001-2 issued on May 26, 1953 to E. T. Clayton and assigned to Tainton Co.

Anode Polarization in Rochelle Copper

Question: We are operating a Rochelle type copper and frequently have difficulty with anode polarization. We have tried many treatments and corrections and have failed to cure the illness. We are not encountering poor or rough deposits, but we are failing to achieve the necessary anode corrosion, in addition thereto the anodes appear most unsightly due to the dark smut formed.

V. F. S.

Answer: To avoid polarization of anodes in a rochelle copper solution you should use steel sheets for about 5% of the anode surface. Because the cathode efficiency of this bath is about 75%, as against 100% for the copper anodes, the use of a small amount of steel will not result in depletion of the solution.

Gold Lacquered Brass

Question: A prospective account of ours engaged in the manufacture of ornate picture frames is presently interested in a gold finish for his line of items. He had made attempts with other metal finishers who tried the customary bright nickel base and brass flash with a gold tinted lacquer method. The outcome was poor uniformity of color, either in the brass flash or in the application of the gold tinted lacquer. I realize that a gold flash and clear lacquer would overcome this condition, but would also make the cost prohibitive. Being a job-shop finisher, my problem is to achieve an imitation gold finish which has ease of color control with regard to solution and also with cost.

D. D. R.

Answer: A properly operated bright nickel and flash brass bath will give a uniform color. However, if the non-uniformity produced by a tinted lacquer is unacceptable because of varying thickness of lacquer film, we would suggest that you use a gold dye lacquer system in which the part is clear lacquered, then dipped in the dye, rinsed and dried. The penetration of the dye will be uniform despite the varying thickness of lacquer.

Color Buffing for High Finish

Question: Can you please give me information on buffing of copper, brass and nickel plate to get a mirror finish. I followed all the information as near as I could in the METAL FINISHING GUIDEBOOK, but still have very fine lines in the finished work, if held in bright sunlight.

W. S.

Answer: The finest finishes are obtained by using the softest wheels, such as flannel or domet cloth and jewelers' rouge, which is obtainable from any buffing composition supplier. The wheel should rotate at a speed sufficient to give a lineal speed of 6,000-8,000 ft./min.

Tacky Surface on Anodized Aluminum

Question: Occasionally, especially during hot humid weather, we encounter "tacky" or sticky anodic films, more often on black anodized parts. The parts are anodized in a sulphuric acid electrolyte, 18% by weight. The solution temperature is held at 68-74°F. After anodizing, parts are subsequently dyed black and there-

after sealed in a solution containing 5 grams per liter nickel acetate, the parts are then dried in an oven at 240°F.

V. F. S.

Answer: The tacky film on anodized parts may be due to improper operation of the nickel acetate bath. We would suggest that you rinse after the nickel acetate. The seal should also be maintained at a pH of 5.3-5.5 and the addition of 0.5% boric acid will help to avoid the condition. Use acetic acid to maintain the pH.

Coloring Tin

Question: We would like to oxidize our tin plated lock parts to obtain a gray or a black finish. At the moment we are cadmium plating these articles but would like a cheaper finish.

O. S. S.

Answer: A gray-black color on tin can be produced by immersion at room temperature in the following:

Arsenious oxide	10 oz.
Copper sulfate	5 "
Ammonium chloride	1 "
Muriatic acid	½ gal.
Water	½ "

A good black color can be produced by anodizing at 40 amp./sq. ft. in a hot solution of 100 g./l. sodium phosphate and 20 cc./l. phosphoric acid.

Cleaner-Copper Bath

Question: Can you kindly send me the solution mixture of a copper cyanide bath which has more sodium cyanide in the solution than copper cyanide. It cleans the steel and plates at the same time.

A. J. C.

Answer: Combination cleaning and copper plating baths have not been employed in this country for many years because of the difficulty of control. They appear to be popular, however, in parts of Europe, and a typical formula would be as follows:

Caustic soda	8 oz./gal.
Sodium cyanide	8 "
Soda ash	8 "
Copper cyanide	2 "
Sodium silicate	1 "

The above amounts of sodium cyanide and copper cyanide can be added to many proprietary cleaners but only flash deposits of copper are suggested because heavy plates will tend to be granular, even if a brightener such as sodium thiosulfate is added.

Impurities in Water Supply

Question: What would you consider as the maximum amount of impurities in well water, particularly a surface well water, that could be tolerated for electroplating purposes. We use over 200 gallons per minute at present.

P. B. K.

Answer: The amount of impurities which can be tolerated in a water supply will depend on the type of finishing processes and the quality required in the finish.

There are no standards which could be employed as general practice; each plant must be considered individually. However, in view of the well-known benefits obtainable when using a pure water supply, a deionizer would be considered a wise investment.

SCIENCE FOR ELECTROPLATERS

(*Continued from page 64*)

example, is most widely used as a buffer in nickel tanks.

Buffer action refers to the resistance, to other than small variations, in the hydrogen ion concentration, pH, when small amounts of acid or alkali are added to the solution. Such a study is indicated in Fig. 36 where changes in pH were observed when acid and alkali were added to solutions containing fixed concentrations of nickel sulfate, and nickel with boric acid as the buffer. The curves show that more acid or alkali is necessary to produce a change in the pH range of between 4 and 6 when the solution contains boric acid, than in the nickel sulfate solution without the boric acid. The pH value indicated on the curves represent colorimetric determinations that have not been corrected, hence are likely to be about 0.5 pH too high.

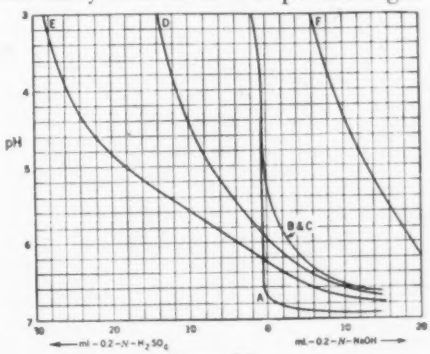


Figure 36.

The usual plating baths in operation, particularly the alkaline baths, show sufficient buffer action so that pH readings that indicate the specified readings are, as a rule, sufficient.

Buffer Solutions

The increasing use of electrometric pH instruments for determining pH values requires a rapid and accurate method of calibrating the meter. Buffer solutions of known pH value are available for such checking operations. Buffer tablets are also available for such purpose. As many as fifty different tablet formulas are obtainable. These cover the pH range from 2.0 to 11.8, varying by 0.2 pH. A fresh buffer solution is rapidly prepared by dissolving one tablet in 100 ml. of fresh distilled water.

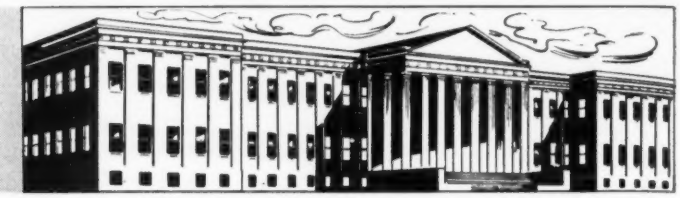
Buffer mixtures consist essentially of mixtures of a weak acid and a salt of the weak acid, a weak base and the salt of the weak base, and sometimes two salts which represent different stages of polybasic acids. An example of such mixture is monosodium phosphate, NaH_2PO_4, which acts as the acid; and disodium phosphate, Na_2HPO_4 as the corresponding salt. Some examples of buffers, showing ranges of pH values from 2.2 to 12.0, are listed in Table 1.

Table I — Buffer Solutions

Composition	*pH range*
Potassium acid phthalate and hydrochloric acid	2.2 - 3.8
Sodium phenylacetate and phenylacetic acid	3.2 - 4.9
Potassium acid phthalate and sodium hydroxide	4.0 - 6.2
Potassium dihydrogen phosphate and sodium hydroxide	5.8 - 8.0
Boric acid and borax	6.8 - 9.2
Diethylbarbituric acid and sodium salt	7.0 - 9.2
Borax and sodium hydroxide	9.2 - 11.0
Disodium hydrogen phosphate and sodium hydroxide	11.0 - 12.0

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Antimony-Lead Deposits on Wire

U. S. Patent 2,718,494. *Sept.* 20, 1955. *C. L. Faust, assignor to the United States of America*

In the method of co-electrodepositing a lead and antimony alloy coating directly upon copper wire said coating containing about 12% by weight of antimony and 88% by weight of lead. comprising immersing the copper wire in an electrolytic bath consisting substantially of an aqueous solution of about 7.5 grams per liter of basic lead acetate, 18 grams per liter of sodium hydroxide, 3.5 grams per liter of sodium hydroxide tartrate, 19 grams per liter of potassium antimonyl tartrate, and 12 grams per liter of potassium tartrate, passing an electric current through the bath in such a manner so that the copper wire to be plated is made the cathode, regulating the electric current to provide a current density of about 19 amperes per square foot and heating the bath to a temperature of about 75° F. to 85° F.

Corrosion Preventive Oil

U. S. Patent 2,718,500. *Sept.* 20, 1955. *H. W. Rudel and M. Gargisa, assignors to Esso Research and Engineering Co.*

A rust inhibited composition comprising a major proportion of a hydrocarbon, 0.00025 to 0.5% by weight, based on the total composition, of an oil soluble acid ester of a phosphorus acid containing at least one hydrocarbon radical of 3-20 carbon atoms and 0.00025 to 0.5% of an alkyl mercapto acetic acid having about 8-20 carbon atoms in the alkyl group, the total amount of said ester and alkyl mercapto acetic acid being sufficient substantially to inhibit rusting by said hydrocarbon.

Burnishing Mat

U. S. Patent 2,718,736. *Sept.* 27, 1955. *C. C. Kinker, assignor to Gerity-Michigan Corp.*

In a burnishing mat or the like having a plurality of resilient rubber-like abrading fingers, a sleeve of pliant plastic material impregnated with material, fitted over and covering the burnishing end portion of each finger, and means to releasably engage said impregnated sleeve and finger.

Polishing Wheels

U. S. Patent 2,718,737. *Sept.* 27, 1955. *J. Myer.*

A polishing wheel of the character described comprising, a cylindrical block having a flat end face with a central conical depression therein, and having an axial threaded hole communicating with said depression, an abrasive cloth having a rim section adhesively secured upon said end face and being substantially commensurate therewith, and having a central conical section fitting in said depression and apertured over the hole, and a screw threaded into the hole and having a head with a conical underface bearing on the conical section of the abrasive cloth for anchoring the latter and with a flat top disposed below the surface of the rim section of the cloth, the block having a series of annular grooves in the cylindrical surface thereof to provide a series of annular fins for conducting heat away from the block and the rim section of the abrasive cloth when the latter is rotated at high speed, and the fins being disposed substantially in alinement with the rim section of the abrasive cloth, and the hole extending uniformly through the length of the block and being threaded for attachment to a rotary driving element.

Acid Brick Floor

U. S. Patent 2,718,829. *Sept.* 27, 1955. *R. B. Seymour and R. H. Steiner, assignors to The Atlas Mineral Products Co. of Pa.*

An acid and alkali resistant structure comprising a Portland cement supporting structure, a resin layer adhered to said supporting structure, said resin layer being selected from the group consisting of bisphenol-epichlorhydrin, bisphenol-glycerol and a liquid polyhydric alcohol ester of an unsaturated polybasic acid modified with a liquid monomeric unsaturated polymerizable hydrocarbon; molded clay blocks set in said resin layer in spaced apart relationship, and a resin selected from the group consisting of polyfurfuryl alcohol, furfuryl alcohol-furfural, furfuryl alcohol-formaldehyde and furfural-ketone resins in the spaces between said molded clay blocks and adhered to said resin layer and to said blocks.

Chromium Plating Process

U. S. Patent 2,719,095. *Sept.* 27, 1955. *J. P. Scanlan, assignor to American Electro Metal Corp.*

In the method of producing a corrosion-resistant exterior on a shaped metal body, such as a compressor blade, formed out of ferrous metal particles sintered into a shaped porous skeleton and infiltrated with a cuprous metal infiltrant filling the pores of the skeleton and thereafter heat-treated to give it great strength, the procedure comprising selectively removing from an exposed surface layer of said body to a depth of about 0.0005 to about 0.001 inch in thickness substantially all free copper present on the outwardly facing areas of and in the pores between the ferrous metal particles of said surface layer and thereafter subjecting said surface layer to a chromium depositing treatment in which chromium from a chromium compound is deposited on the ferrous metal particles of said layer and caused to form with the ferrous metal of said exterior surface layer a substantially continuous, dense, oxidation and corrosion-resistant enclosure tightly anchored to the exterior of said body and suppressing corrosion of underlying copper infiltrated strata of said body.

Porcelain Enameling Aluminum

U. S. Patent 2,719,796. *Oct.* 4, 1955. *W. R. Kappes, R. V. Vanden Berg and R. A. Wodehouse, Jr., assignors to Aluminum Co. of America*

The process for producing an adherent enamel coating on aluminum which comprises treating the aluminum in an aqueous acid solution containing between 2 and 4 per cent by weight of chromic acid and between 10 and 25 per cent sulfuric acid, at a temperature of between 70 and 100°C., for a period between 1 and 5 minutes, and thereafter enameling the aluminum with an enamel having a melting point below about 580°C. by applying the enamel to the aluminum and firing the same above the fusing point of the enamel at a temperature between 500 and 580°C.

Continuous Hot Dip Coating Steel

U. S. Patent 2,719,820. *Oct.* 4, 1955. *W. S. Allen, assignor to U. S. Steel Corp.*

A method of applying to steel strip coatings of metals of the group consisting of tin, terne, lead and zinc comprising electrolytically applying to the strip a lightweight prime coating of one of said metals, said prime coating being of a weight equivalent to 0.1 to 0.2 pound per base box, introducing the strip to a sealed enclosure having a non-oxidizing atmosphere, spraying a heavier coating of one of said metals on the strip within said enclosure, heating the strip within said enclosure and controlling the heating so that the strip surface attains a temperature sufficient to melt the prime coating and alloy the coatings with the strip surface in the vicinity of the point where the heavier coating is sprayed thereon, and quenching the strip.

Gold Alloy Plating Bath

U. S. Patent 2,719,821. *Oct.* 4, 1955. *C. R. Campana*

An electrolytic bath for depositing an acid-resistant, tarnish-proof, gold alloy plate, said bath comprising essentially an alkaline aqueous solution containing gold, palladium, and at least one of the metals selected from the group consisting of copper, nickel and cadmium, and containing per gallon of water, between 0.5 and 1.5 oz. of gold cyanide, between 0.166 and 0.5 oz. of palladium chloride, and of the metals which are to be co-deposited with the gold and palladium, each as its cyanide compound, the following amounts, between 0.5 and 1.5 oz. of each of copper and nickel, and between 0.05 and 0.16 oz. of cadmium.

Pusher Type Automatic Plating Apparatus

U. S. Reissue Patent 24,072. *Oct.* 11, 1955. *J. V. Davis, assignor to The Udylite Corp.*

In a conveying apparatus, a series of receptacles, an alined series of spaced rail sections fixedly supported over said receptacles, a chassis movably mounted over said receptacles, means for moving said chassis up and down over said receptacles, a series of spaced rail sections carried by said chassis and adapted to fit in the spaces between the first named sections in the lower position of the chassis, slidably mounted pusher bars carried by said chassis, means for reciprocating said bars, lengthwise adjustable pushers carried by said bars in close proximity to the movable rail sections and adapted to engage work on the several rail sections in either position of the chassis, and means for sliding said bars in both positions of the chassis.

Stripping Tin from Copper

U. S. Patent 2,721,119. *Oct.* 18, 1955. *F. Bauch, assignor to General Motors Corp.*

The process of stripping tin from metal containing a substantial proportion of copper which includes removing any organic material if any which may be covering the tin, immersing the tin coated metal containing copper in a dilute sulphuric acid solution containing as the essential ingredient copper ions in the amount of 28 to 56 grams per liter for a period of time sufficient to strip the tin from the metal and then immersing the metal in a bright dip solution containing nitric and sulphuric acids.

Buffing Machine Attachment

U. S. Patent 2,719,391. *Oct.* 4, 1955. *E. K. Brown, assignor to The Torrington Co.*

A top roll supporting and rotating attachment for buffing machines for buffing cots thereon comprising bracket arms adapted to be attached to a buffing machine, a bed carried by said bracket arms, standards at the ends of the bed, bell-crank levers having arms pivotally supported at the upper ends of said standards and depending therefrom, arms formed integral with the bell-crank levers, a rod connecting the ends of said last named arms, a driven pulley mounted on one of the standards with its axis in alignment with the pivotal supports for said arms, a roller mounted at the ends of said arms for rotating the rolls with the cots thereon, means for rotating said roller from the driven pulley, supporting brackets carried by said bed, each bracket having an upwardly facing V-shaped recess adapted to receive the supporting mandrel for the rolls, and means connected to said depending arms for holding said driving roller in engagement with said cots.

Contact Roll for Abrasive Belt Polishing Machines

U.S. Patent 2,720,061. *Oct.* 11, 1955. *E. L. Anderson, assignor to Rockwell Spring and Axle Co.*

An abrasive belt polishing machine including a contact roll, a second roll spaced therefrom, an endless abrasive belt passing around said rolls, and means for driving one of said rolls, wherein work to be polished is pressed against the abrasive belt at a portion of the belt backed by the contact roll, the improved contact roll comprising a wire brush wheel including wires having their outer ends engaging said belt.

Abrasive Wheels

U.S. Patent 2,720,064. *Oct.* 11, 1955. *M. C. Klug*

An abrasive wheel having flexible arms projecting from the periphery thereof in spaced relation one to another and flexible abrasive strips overlying the leading faces of said arms, the improvements which comprise compressible elastic hub segments of the wheel formed to engage opposite sides of the inner end portions of the several abrasive strips and clamping means disposed to compress adjacent hub segments in gripping engagement with opposite sides of said end portions of the several abrasive strips.

Degreasing Tank

U.S. Patent 2,720,210. *Oct.* 11, 1955. *C. G. Lueck.*

A parts cleaner comprising a tank for holding a pool of solvent, a gas diffuser assembly located adjacent the bottom of the tank and having ports

for discharging gas into the solvent with the ports being arranged to discharge approximately horizontal and vertical jets of gas which converge along a plurality of directions to produce turbulence in the solvent so that it will penetrate into and around irregular contours and passageways of the parts to be cleaned, a conduit connected to the gas under pressure, and a restriction located inside the conduit and defining an orifice for preventing an excess rate of flow of the gas into the diffuser assembly so as to limit the rate of evaporation of the solvent and so as to prevent the solvent from being blown out of the tank due to the pressure provided by the source of gas.

Pickling & Pickle Recovery

U.S. Patent 2,720,472. *Oct.* 11, 1955. *C. O. Miller, assignor to Cleveland Industrial Research, Inc.*

A process for pickling ferrous metal which comprises the steps of immersing said metal in an aqueous pickling bath of an alkali metal acid sulphate selected from the group consisting of sodium acid sulphate and potassium acid sulphate to yield alkali metal sulphate in aqueous solution, then by a process including the step of oxidation and raising the pH to at least 7 with an ammonia-containing fluid, thereby converting said ferrous alkali metal sulphate to oxide of iron and the corresponding alkali metal ammonium sulphate, recovering said alkali metal ammonium sulphate from the resulting solution, and heating said alkali metal ammonium sulphate to convert it to the corresponding alkali metal acid sulphate and returning said acid sulphate to the pickling operation.

Zinc Dross Recovery

U.S. Patent 2,721,813. *Oct.* 25, 1955. *T. F. Holmberg, assignor to Berndt Gronblom.*

A method of separating zinc contained in zinc-iron alloys, zinc dross and reduced zinc in iron-bearing zinc ores comprising introducing the zinc-iron material into a molten lead bath maintained at a temperature above about 600° C. whereby zinc is dissolved in the lead and iron, which is insoluble in said lead, floats on the surface of said bath, separating the insoluble iron from said bath, lowering the temperature of said bath to about 420°-460° C. whereby an upper layer of zinc separates which is adapted to be removed from said bath at said lower temperature.

Copper Backing Mirrors

U.S. Patent 2,720,487. *Oct.* 11, 1955. *M. Meth.*

The method of making a mirror which consists in supporting a transparent plate on a rack, in applying silvering solutions thereto whereby the plate is silver coated, in immediately water rinsing said coating, and while the coating is still wet from rinse water immediately applying thereto a spray of 6 to 40 ounces of copper sulphate and ¼ to 2 ounces of phosphoric acid per gallon of water and simultaneously applying thereto a mixture composed of 1 to 6 ounces of finely divided metal dust per gallon of water, said metallic dust being homogeneously suspended in the water, said metallic dust being selected from the group of metals consisting of zinc, iron, cadmium, nickel, cobalt and chromium.

Hot Tinning

U.S. Patent 2,712,149. *Oct.* 18, 1955. *J. W. Nelson, assignor to Sinclair Refining Co.*

In hot dip tinning operations wherein freshly-tinned steel plate is passed through a bath of a tinning oil maintained at an elevated temperature, the step of contacting the steel plate with a tinning oil comprising a mixture of high molecular weight microcrystal-

line wax acids produced by substantially complete oxidation of microcrystalline wax containing 34 to 55 carbon atoms per molecule which is characterized by extreme water insolubility and by a saponification number less than about 200 and which predominates in monocarboxylic acids having an apparent chain length exceeding eighteen carbon atoms per molecule.

Oblique Tumbling Barrels

U.S. Patent 2,721,426. *Oct.* 25, 1955. *C. B. Vincent.*

Shaking barrel apparatus comprising a skeleton frame, a bed on the frame presenting an inclined flat upper surface, a plurality of spaced housings mounted on said surface of the bed, a spindle journalled in each housing and held fast against axial displacement, each spindle projecting upwardly and outwardly with respect to the plane of the bed, a power unit mounted on the frame, driving means located beneath the bed and drivably coupled to the lower ends of spindles and adapted to drive all the spindles simultaneously from the power unit, a cup-like member carried on each spindle and including a bottom portion and an upwardly projecting rim, the upper end portion of said spindle projecting upwardly from said bottom portion and said rim defining a conical seating spaced from and surrounding the upper end portion of the spindle, a shaking barrel associated with each spindle, a boss projecting from the base of each barrel and including an axial socket adapted to receive the upper end portion of the spindle, and a conical peripheral wall complementary to said conical seating, whereby the barrel can be drivably coupled to the spindle, while the latter is rotating, by an engagement of said rim with said peripheral wall after coaxiality of said spindle and said barrel having been ensured by said spindle end engaging in said socket.

Electroless Nickel

U.S. Patent 2,721,814. *Oct.* 25, 1955. *H. J. Jendrzynski and T. F .Stapleton, assignors to General Motors Corp.*

A method of depositing nickel from a chemical reduction plating bath, said method comprising immersing a catalytic article to be coated in a solution of nickel ion and a hypophosphite reducing agent capable of reducing the nickel in solution, said solution having a nickel ion concentration of less than about 10 grams per liter, a hypophosphite ion concentration of less than about 25 grams per liter, a temperature within the range from about 165° F. to 190° F. and an initial pH within the range from about 5.8 to 7.2, and allowing said article to remain in said solution until the nickel is substantially completely reduced as evidenced by the solution turning from green to colorless.

Pickling and Regenerating Machine

U.S. Patent 2,721,562. *Oct.* 25, 1955. *R. L. Irvine, assignor to Belle Fons Chemical Corp.*

A pickling apparatus for iron which comprises an elongated tank having pickling, diluting and rinsing sections, said sections being separated by liquid overflow barriers, the barrier between said rinsing section and said diluting section being higher than the barrier between said diluting section and said pickling section, and evaporating means, a conduit connecting the end of said pickling section farthest from said rinsing section with said evaporating means, a second conduit for delivering concentrated acid from said evaporating means to said diluting section, a means for separating solids from liquid in the line of said second conduit between said evaporating means and said diluting section, means for introducing make-up acid into the

said second conduit between said evaporating means into water, and a conduit for delivering said water to the end of said rinsing section farthest from said pickling section.

Tunnel Spray Washer

U.S. Patent 2,721,564. *Oct.* 25, 1955. *T. J. Kearney, assignor to Detrex Corp.*

In washing apparatus of the character described, a tunnel housing through which work to be cleaned is passed; an open top sump at the bottom of the housing for wash liquid; a gas fired heating coil submerged in the sump and terminating in an upright stack which extends slightly above the liquid level in the sump; pipes, with spray nozzles at different elevations, arranged along opposite sides of the tunnel; pump means for continually drawing liquid from the sump for discharge from the nozzles upon the work as it is progressed through the housing, a baffle arranged transversely of the tunnel immediately above the top of the stack of the heating coil whereby the combustion gases are laterally diffused within the tunnel for absorption of heat therefrom by the liquid being sprayed, said baffle being in the form of a catch trough for temporarily retaining and heating the trapped spray liquid and from which the collected liquid continually overflows into the sump for re-use in the washing operation.

Parts Washer

U.S. Patent 2,721,566. *Oct.* 25, 1955. *W. E. Brucker.*

A parts cleaning device comprising a cylindrical tank for cleaning fluid, said tank including a bottom having a conically sloping central portion provided with a drain orifice for silt laden cleaning fluid, a supporting platform secured on said bottom, a shaft rotatably mounted on said supporting platform and extending co-axially within said tank, an article holding platform mounted on said shaft for rotation therewith, article holders on said article holding platform, means for causing rotation of said shaft, a cover for said tank, a spray head mounted in said cover, means for supplying under pressure liquid and air to said spray head simultaneously or separately selectively, spray nozzle carried by and communicating with said head for discharging fluid against the article holders on said article holding platform.

Basket Plating

U.S. Patent 2,721,834. *Oct.* 25, 1955. *F. Koury, assignor to Sylvania Electric Products, Inc.*

Apparatus for electroplating a large number of small parts concurrently, including an open-top container for electrolyte, an anode carried on the side wall thereof and being vertically disposed, a metal pan having resilient supporting means and having a vertical-stroke vibrator connected thereto as a unitary assembly, and an elevator mechanism for raising and lowering said unitary assembly including said pan and its vibrator between the electrolyte and a position of clearance for loading the parts into the pan and immersing the parts in the electrolyte without obstruction by the anode.

Electrodeposition of Manganese

U. S. Patent 2,717,870. *Sept.* 13, 1955. *R. S. Dean*

The method of electro-depositing a smooth bright plate of manganese which includes the steps of passing a unidirectional current between an anode and an insoluble cathode in a single compartment cell containing as the electrolyte an aqueous solution having a composition of 10-15 grams per liter Mn, 6-17 moles per liter NH_3 and a simple anion forming a salt with manganese at least as soluble as manganese sulphate, in an amount at least stoichiometrically equivalent to the amount of manganese present in the solution, said solution being strongly ammoniacal and having a pH of 9.0-10.5 and the manganese being predominantly in the anion, the current density at the cathode being 100-1,000 amperes per square foot and the current density at the anode being less than that at the cathode, and maintaining the temperature of said electrolyte below 45° C.

ABSTRACTS

Phosphating of Aluminum

Aluminium. Vol. 29, No. 12, pp. 509-513.

The known phosphating processes for steel and zinc cannot be applied directly to aluminum. Special modifications have to be considered in this

connection. A suitable process is given as follows:

Acid zinc phosphate	2.8%
75% Phosphoric acid	2.5%
Chromic acid	1%
Wetting agent	0.5%

The working temperatures are between 38 and 55°C. with dipping times of about 4 minutes.

Electroless Thick Nickelling by the Nirestan Process

Metallwarenindustrie und Galvanotechnik. Vol. 45, No. 6, pp. 299-300.

Details are given of the electroless nickel coating Nirestan process. As with all the other electroless nickel processes, this is based on reduction by hypophosphite.

Immersion Tinning Processes for Brass and Copper

Metallwarenindustrie und Galvanotechnik. Vol. 45, No. 6, pp. 293-294.

For immersion application of tin coatings to brass and copper, the following solution can be used:

Tin chloride	25 g./l.
Tartaric acid	10 g./l.

The solution is used at 80°C. in a barrel unit. The parts to be tinned are added to the barrel with some pieces of zinc metal, preferably in a flocculent or powder form. The drum is then revolved. In place of a barrel, an enamelled iron pan can be used as container. In this case, the parts are placed in an iron basket and dipped in the liquid with constant movement. The duration of the treatment is about 2-4 hours.

Alternative dip-tinning solutions which can be used are as follows:

Tin chloride	10.5 g./l.
Sodium pyrophosphate	17.5 g./l.

or

Tin chloride	25 g./l.
Sodium chloride	25 g./l.

These solutions are used as above, but small pieces of tin are used in place of the zinc parts, for activation.

Another solution is:

Tartaric acid	1.5 g./l.
Sodium chloride	3 g./l.

With this solution no tin salts are necessary. The bath is heated to 85°C., preferably in an enamelled iron pan. The parts to be tinned are loaded in a thin layer on an iron screen and covered with a perforated pure tin sheet. The treatment time is about 3-5 hours.

Another bath which can be used consists of:

Tin oxide	15-30 g./l.
Sodium hydroxide	30-60 g./l.

This bath is used as above.

A further bath composition is given as:

Tin chloride	15 g./l.
Sodium hydroxide	22.5 g./l.
Sodium cyanide	3.75 g./l.

This solution is brought to boiling in an enamelled iron pan. The parts to be tinned are placed on an iron screen. The treatment time is about 20 minutes.

Metal Coloring Processes for Copper

Metallwarenindustrie und Galvanotechnik. Vol. 45, No. 6, p. 281.

Brown-black:

Liver of sulfur	10 grams
Water	1 liter
Temperature	80°C.

Brown-black:

Liver of sulfur	10 grams
Schlippes Salt	10 grams
Water	1 liter
Temperature	20-30°C.

Light Brown:

Copper sulfate	20 grams
Potassium permanganate	5 grams
Water	1 liter
Temperature	70-80°C.

Brown:

Sodium chlorate	100 grams
Ammonium nitrate	100 grams
Copper nitrate	10 grams
Water	1 liter
Temperature	100°C.

Brown: A solution of sulfur-gold with alcohol is applied. The ware is gently dried and then scratch brushed.

Green:

Ammonium chloride	60 grams
Copper acetate	60 grams
Water	1 liter

The solution is sponged on cold to the ware.

Patina Green: A solution of 25-100 g. copper nitrate in 1 l. water is sponged on the warm material. This coating can be blackened over a gas flame and then the green patina coloration can be stippled over this with a sponge.

Blue:

Sodium thiosulfate	135 grams
Lead acetate	35 grams
Water	1 liter
Temperature	60-70°C.

Hydrogen Embrittlement in Hard Chrome Plate and Its Removal

G. Dehmel: *Metallwarenindustrie und Galvanotechnik.* Vol. 45, No. 2, pp. 63-64.

Many metals show "embrittlement" caused by internal stresses originating from the absorption of hydrogen which is deposited simultaneously with the plated metal and which leads to lattice disturbance of the metal crystal, hardness, and an unsound metal structure. This phenomenon shows up prominently in hard chromium plating where the cathode efficiency is 10 to 20% so that a large amount of hydrogen is codeposited, which diffuses into the chromium and into the base metal. The viewpoint is often held that the hardness of a chromium plate is directly ascribable to the hydrogen content of the metal but tests have served to show the opposite. It has often been found that hard chromium coatings with a low hydrogen content have considerably greater hardness than those with a higher hydrogen content.

It has been shown by Pfanhauser that a bright chromium coating contains about 200 times its volume of hydrogen, while the hydrogen content with matt and rough chromium coatings can amount to 1,500 times the chromium volume. Often, hydrogen embrittlement of hard chromium coatings only shows up with subsequent mechanical working. Particularly with heavy coatings, the deposit will generally tend to flake away, if it is going to do so at all, during the subsequent grinding to dimensional size. Often, a blow is sufficient to cause the brittle chromium coating to peel away.

The obvious steps to take to avoid this trouble are to remove the brittleness from the chromium coating by removing the hydrogen. The hydrogen can be removed very simply by heat-

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★ **LEABRAMENT** . . . liquid abrasive composition for wheels and belts; contains coarse grains. Can be brushed on.

★ **LEA PLASTI-BRADE** . . . liquid abrasive composition containing the finer grains. Can be sprayed or brushed on.

★ **LEA LAPPING PASTE** . . . exceptionally fine grain pastes for precision work; grains in sub-micron sizes carefully graded.

If you are interested in obtaining better finishing and/or lower costs, do two things: one, call on the LEA Technical Service; two, specify LEA as the source for the finishing compositions. In LEA Products you will get maximum values from quality abrasives properly graded.

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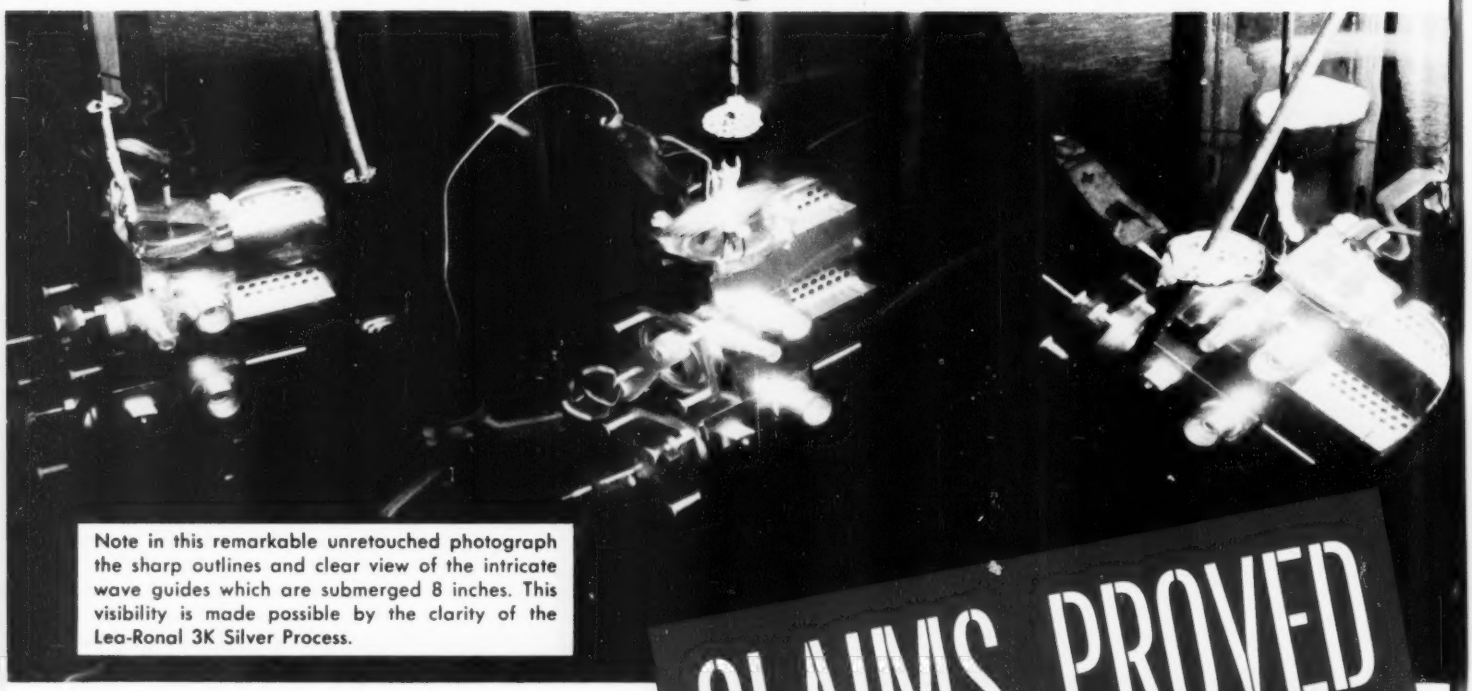
LEA-RONAL 3K *Bright Silver* plating process



Note in this remarkable unretouched photograph the sharp outlines and clear view of the intricate wave guides which are submerged 8 inches. This visibility is made possible by the clarity of the Lea-Ronal 3K Silver Process.

CLAIMS PROVED

. . . says Premier Instrument

Two years ago when we announced our 3K Bright Silver Plating Process for industrial end-use, we listed the following advantages:

**** Stable solution ** Clear solution, work visible at all times ** Operable with high current density ** Faster plating • Bright deposits • High tarnish resistance • Convertible from *any* silver bath • Suitable for barrel as well as tank plating**

The double asterisk (**) is used purposely. When Premier Instrument Corporation of New York, one of the pioneers in the manufacture of wave guides, first started using the process some time ago, they were interested in all 3K advantages, of course, but those so marked were a 'must' because of the nature of their contract work and their own products. In LEA-RONAL 3K, they found all they wanted—the double asterisk advantages ** and in addition, finer grain structure than deposits from conventional plating baths formerly used.

Yes, Lea-Ronal 3K provides the *superior* silver plating bath for industrial end-use. It may well be just what you need to (1) improve your silver plate and/or (2) reduce your costs. A letter or phone call asking for further information will bring prompt response.

For those in decorative plating, the Lea-Ronal 3K Silver Process with a slight modification can be used.

Our technical staff is always available for recommendations and service in connection with any special plating problem.

PRODUCTS OF RESEARCH L·R Metallurgy Electroplating DEVELOPERS OF ELECTROCHEMICAL PROCESSES

Lea-Ronal *Inc.*

Main Office and Laboratory:
139-20 109th Avenue, Jamaica 35, N. Y.
Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.

The LEA GROUP
serving the Finishing Field
Lea-Ronal, Inc., Jamaica, N. Y.
Lea-Michigan, Inc., Detroit
The Lea Mfg. Co., Waterbury, Conn.
Lea Mfg. Co., of Canada, Ltd.
Lea Mfg. Co., of England, Ltd.
Plating Polishing Buffing Burring

Are you interested in Buffing, Polishing and Burring Specialties? SEE THE OTHER SIDE OF THIS INSERT.

ing the plated workpiece in an oil bath at about 180 to 200°C. According to the thickness of the coating, a half to two hour treatment is necessary. Quite often, merely heating the plated part to temperatures above 95° C. will do but, for practical considerations, this treatment is not really satisfactory. Many other complicated treatment processes have been proposed in patent form and otherwise, but they are too difficult to execute practically and the oil bath treatment is the most practical and simple measure to adopt.

Aftertreatment of Hard Chromium Plate — Grinding and Lapping

H. Benninghoff: Vol. 45, No. 3, pp. 106-107.

Great care must be given to the correct choice of the grinding medium, grinding wheels, peripheral speed of the grinding wheels, the grinding wheel feed, etc. It is general knowledge that hard grinding wheels are used for soft materials and soft grinding wheels for hard materials. Too-hard a grinding will cause breaking-off of parts of the deposit, "burning" of the surface, cracks in the surface, overheating of the part, etc. A medium hardness grinding wheel is preferable even though the wheel wear is higher. Emery wheels of grades I, J, K, and L are best suited with grain sizes 36 and 46 for general grinding, 60 for a following fine grind, 80 for a very fine grind and 500 for a grind bordering on lapping. Good results have been obtained with the use of Alundum 60 K or 80 K for a first grind, followed by a finishing grind with 100 K. Aloxite 180 -R -S 30 can also be used for a finishing grind.

Hard chromium coatings can be ground wet or dry. Best results, however, are obtained with a wet grind. The depth of cut with a wet wheel should amount to 0.0005″. A good feed of an oil emulsion for cooling and lubrication should be used. The circulating coolant must be passed through a filter so that all the particles which are formed during the grinding are filtered out. If these particles are not carefully removed, craters and cracks will be formed on the surface. With a dry grind, the depth of cut should amount to about 0.0001-2″.

Lapping is a fine grind of 0.00025-30″. Cast iron laps are used with a suitable lapping medium and also aluminum discs with an emery medium. Honing of hard chromium is conducted with a 120 to 180 grain. If metal laps cannot be used, good results can be obtained with plastic laps.

Can Hard Anodizing be a Substitute for Hard Chromium?

Metallwarenindustrie und Galvanotechnik. Vol. 45, No. 3, pp. 115-116.

Hard anodizing is intended only for industrial applications and not for decorative effect. It is used where considerable surface hardness and resistance to wear is required. According to the aluminum alloy used, the hard anodized coatings have a light to dark color. The coating is characterized by hardness, compactness and thickness with wear and corrosion resistance as well as good frictional characteristics and electrical insulating effect. The Vickers hardness amounts to about 520 kg./sq. mm. Wear tests have indicated a higher wear resistance than with hard chromium. A 50% less wear value has been established as compared with case-hardened steel.

The coating thickness with hard anodizing amounts to about 0.025 mm. up to 0.05 mm. As in hard anodizing an increase in volume takes place, the dimensional change caused by the anodizing amounts to about 50% of the thickness of the coating. It is necessary therefore to prepare the part under dimension. Certain wrought and cast alloys are suitable for hard anodizing. The coating is produced at a speed of about 1 micron per minute.

Hardness and Wear Resistance of Plated Coatings

By R. Weiner and G. Klein: *Metalloberflaeche.* Vol. 7, No. 1, pp. 1B to 7B (1955).

The test results indicated that micro-impression hardness values and the scratch hardness of metal surfaces often run parallel to a considerable degree. This parallelity is not, however, perfect; particularly with brittle surfaces a marked lowering of the scratch hardness is established, particularly with greater loadings. There is only a very loose connection between the abrasion loss of the metal surface and the hardness figure so that one cannot draw conclusions regarding the wear resistance from measurements of the impression hardness. The connection between wear resistance and scratch hardness is somewhat clearer. Even here, however, it is not possible to draw a hard and fast conclusion from the one value, regarding the other.

Electroplated bright deposits very frequently show greater impression hardness values than those from normal matt baths but, with the scratch hardnesses, the superiority of the bright plated coatings can greatly recede, and as regards the wear resistance, the relationship can even become completely reversed.

The conclusions which are drawn from pure impression hardness measurements, as regards the evaluation of plated coatings, are not tenable. For the evaluation of the wear resistance, it can be assumed that, where the scratch hardness strongly drops as compared with the impression hardness, the wear resistance likewise will be located much lower than would be expected from the pure hardness values alone. Where the impression and scratch hardnesses are not appreciably different from one another, and where no strong drop of the hardness with increasing loading is established, one can reckon on a relatively good wear resistance. These observations then allow of a very good usable conclusion often being drawn on the wear resistance from some rapidly conducted hardness determinations. A very full range of plated deposits were tested, covering hard and soft copper, bright chromium, hard chromium, matt nickel, bright nickel, cyanide copper, bright copper, acid copper, matt silver, bright silver, acid zinc, cyanide zinc, bright zinc, matt cyanide cadmium, bright cadmium.

Black Coloring of Zinc

Metallwarenindustrie und Galvanotechnik, Vol. 45, No. 8, p. 403.

It is recommended that a deep black color on zinc parts is best achieved in the black nickel bath. A still better appearance is obtained if, after the black nickel stage, the ware is rinsed in the following solution:

Water	1 liter
Hydrochloric acid	5 cc.
Iron chloride	25 grams.

The ware is dipped in this bath for about 15 minutes.

Spray Patina Process for Copper and Brass

Metallwarenindustrie und Galvanotechnik: Vol. 45, No. 10, p. 502.

The data given covers a spray process for the formation of a true patina on large copper and brass surfaces, such as roof coverings, door panels, monuments, etc. The process is conducted as follows:

The surface to be treated is first cleaned by rubbing over with an alkali or similar cleaning agent. The coloring solution is then sprayed on to the surface and allowed to dry. The amounts of solution required for specific surface areas can be taken from the following:

Surface sq. dm.	*Ammonium sulfate kg.*	*Copper sulfate kg.*	*Ammonia cc*	*Water liters*	*Total liters*
100	2.5	0.090	4	25	30
200	5	0.190	8	50	60
300	7.5	0.270	12	75	90
400	10	0.360	16	100	120
500	12.5	0.450	20	125	150

Crack-Free Chromium Plate

H. W. Dettner: *Metalloberflaeche*. Vol. 6, No. 5, pp. B 69-B 73.

It is well known that chromium plate, unlike other plated metals, is characterized by a network of fissures. This is caused by the strong hydrogen generation which occurs during the chromium plating. The finest crack network is given by plating baths which contain hydrofluoric acid or fluosilicic acid as the catalyst, then follow the sulfuric acid-hydrofluoric acid baths and, finally, the usual sulfuric acid-containing baths which form the coarsest network. These fissures, which are frequently not visible, can be widened and deepened by etching with or without current. The corrosion resistance of the chromium is, obviously, greatly reduced by these cracks together with any pores that may be present in the coating. It is also difficult to free the deposit from the residual solution trapped in these cracks, even with the most careful rinsing. It is only when a coating thickness of 20 microns, or better still 30 microns, is given, that the cracks and pores grow together to such an extent that sufficient resistance to atmospheric corrosion is obtained.

As chromium metal, by virtue of its passivation qualities, without cracks or pores would offer considerable corrosion resistance as a coating, it would seem to be of advantage to produce a chromium plate which is crack-free. The work of Dow and Stareck in producing crack-free chromium coatings is then critically discussed. It is considered that apart from any special bath composition or current conditions, the bath temperature of 65°C. may be regarded as significant. It is already known that raising of the bath temperature to around this figure of 65°C. serves to give a chromium plate which has considerably improved corrosion resistance.

Electropolishing with Rectified Current

J. Steiner: *Metalloberflaeche*. Vol. 6, No. 5, pp. B 65-B 69.

The extent to which the alternating current component superimposed on the rectified direct current component, i.e. the wave form of the rectified current, exercises a favorable or unfavorable influence on electropolishing, was studied. The current curve forms were ascertained for various electropolishing bath conditions, and the results obtained on brass, copper, and aluminum were then appraised and compared for appearance, effectiveness, etc.

The determination of the polish was conducted with the Lange brilliance tester and also subjectively by visual examination. As it was frequently a question of small differences between the polishing values obtained with the various types of electropolishing currents, the subjective determination by eye was aided by a very simple arrangement which was a modification of the Hunter method.

The results generally served to show that small wave-form currents practically always had either no effect at all or else a favorable influence on electropolishing. Larger wave-form currents had a favorable effect, with many current density—bath ratio conditions, while with other electropolishing conditions there was unfavorable influence.

Blackening of Zinc and Zinc Alloys

R. Souske, Bull. Documentation Technique (France), 1954, pp. 631-662.

For the black coloration of zinc and zinc alloys the parts are first cleaned by cathodic treatment in the following bath:

Sodium cyanide	40 g./l.
Sodium carbonate	50 g./l.
Sodium hydroxide	40 g./l.
Bath Temperature	20° to 30° C.
Treatment time	1 minute
Current density	10 amp./sq.dm.

After cleaning, whether by boiling or electrolytic, the parts are chemically blackened in the following bath:

Commercial ammonium molybdate	100 g./l.
Ammonia (22 Bé)	250 cc/l
Bath temperature	70-80°C.
Treatment time	10-15 minutes

In order to color 20 sq.dm. of zinc surface, about 100 mg. of ammonium molybdate are used. The color has not only a decorative effect but also gives a certain corrosion protection. It was found that the treated parts withstood a 10 hour salt spray test.

Electrolytic Process for Surface Coloring of Brass

E. Stoeckl: *Metalloberflaeche*. Vol. 6, No. 5, p. B 76.

The new Poligrat process developed by the Elecktrolyse Gesellschaft, Munich, Germany is described. The brass parts are treated anodically in an electropolishing bath. The metal removed is deposited in a spongy form on the cathode. If now the current is reversed after the polishing process has been ended, then a re-coppering occurs. According to the thickness of the metal coating, every color tone stage between the bright yellow of brass and copper-red can be produced. This color scale embodies all the gold and red-gold tones which are of interest for the production of metal fancy ware and jewelry.

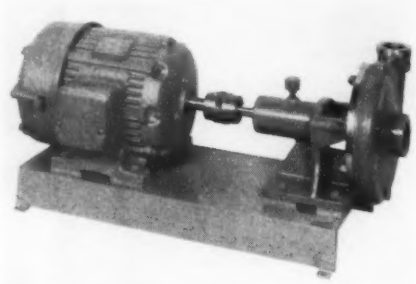
By means of two precision time switches, the polishing time and the coloring time are set according to test. The coloring treatment amounts to a few seconds. After rinsing and drying, the parts merely need coating with a transparent lacquer which does not affect the polish, to give protection against corrosion. The product is self-colored and has a highly polished appearance.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Centrifugal Pump

Steadfast Industries, Inc., Dept. MF, 4731 W. Madison St., Chicago 44, Ill.



The above firm has introduced a centrifugal pump with a patented mechanical seal which eliminates the stuffing box and costly down time. Tests have shown two years of continuous 24 hours a day operation without any maintenance required, according to the above manufacturer.

Tailored to all plating requirements, the pump is available in cast iron, stainless steel, Durimet, Hastelloy, bronze, Hi-Temp lucite and others, depending on requirements. Pump ratings from 300 g.p.h. to 12,000 g.p.h.

Rhodium Solution for Heavy Deposits

Baker & Co., Inc., Dept. MF, 113 Astor St., Newark 5, N. J.

A new rhodium-plating solution has been designed specifically to produce heavier deposits with lower stress in a shorter space of time.

The special solution, known as rhodium-plating solution No. 221, is claimed to plate up to .001" in 70 minutes. It can be used without modification of present equipment.

While this bath is intended for producing specification deposits, it may be used with excellent results for decorative purposes, especially where plating speed is important.

The deposit produced from this bath is also extremely useful in many electrical and electronic application. In general, rhodium protects against corrosion, and improves efficiency whenever a low-resistance, long wearing, oxide-free contact is required. Rhodium plate assures low noise level for moving contacts, no oxide rectification, low and stable contact resistance. Plated over nickel or silver, it provides highly efficient protection for printed circuits, lengthening the life of the circuit, and protecting it against tarnish and corrosion.

Self Priming Filter Units

Sethco Mfg. Co., Dept. MF, 70-78 Willoughby St., Brooklyn 1, N. Y.

An addition to the manufacturer's LSIN line of self priming filter pumps

Model LSIN - 20

for filtering corrosive solutions is Model LSIN-20 which is rated at 200-300 gallons per hour filtering capacity. The design of the filter assembly of this model differs from previous designs of smaller models in the sealing arrangement of the filter tubes. Heretofore, sealing was obtained by means of a cover which sealed both filter tube and filter shell at the same time. The new unit has a separate seal plate for sealing the filter tube as well as a cover for sealing the outer shell of the filter assembly.

These filter pumps will filter most corrosive solutions. Removal of particles from 150 to 1 micron can be controlled by varying the density of the filter tube in the assembly. The choice of filter tubes to be used in the filter assembly depends on the solution to be filtered. Cotton, Dynel, porous stone and porous carbon filter tubes are available.

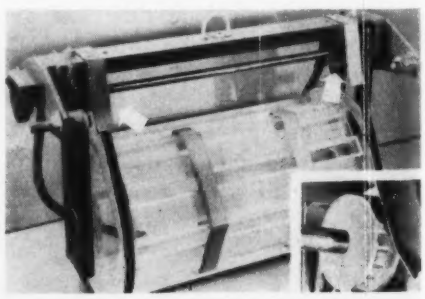
Belt Drive Plating Barrels

G. S. Equipment Co., Dept. MF, 5317 St. Clair Ave., Cleveland, O.

The new "cogged" development offers the first and only V-belt driven barrel not dependent on friction grip alone. Molded V-belts have woven steel tensile members for greater strength ,and won't stretch. They are entirely Neoprene coated for resistance to acids, alkalies and floating oil or grease. H-T Sincolite cogged pulleys are also inert to all solutions.

Cogged - V - belts constant - meshed with matching cogs in the drive pulleys can't slip, creep or vary speed, regardless of loads or other conditions, according to the above manufacturer. They deliver positive, mechanical-type transmission of power, eliminating cylinder-end drive gear, idler gear, pinion gear and their bearings. Ordinarily immersed in solutions, these parts are exposed to corrosive attack and are a constant expensive maintenance and replacement problem.

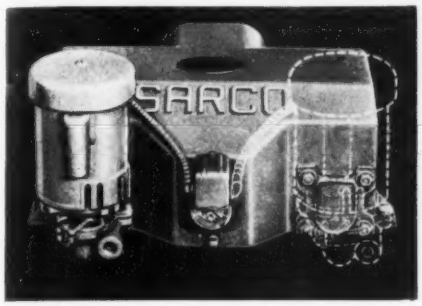
An exclusive feature of all the firm's plating barrels, the new drive is also available on all superstructures in the firm's "replacement" line to fit all



sizes of every standard-make tank. Replacement cylinders for these units are offered in H-T Sincolite or Tempron (hard rubber), both are all-welded, heavy ribbed construction. The new design is suitable for both individual tanks and horizontal automatic barrel plating installations. Complete details are available on request.

Condensate Pump

Sarco Co., Inc., Dept. MF, Empire State Bldg., New York 1, N. Y.



New Type S condensate pumps have been added to the manufacturer's complete line of condensate and vacuum pumps. These close-coupled, bronze-fitted pumps are furnished with a 12 gal cast iron receiver. Capacity, 2,000 to 8,000 sq. ft. EDR and 3450 RPM.

They are easy to convert from single to duplex and features include low 7½" inlet, mechanical seal and dynamically balanced enclosed bronze impeller.

No sub-base is required. The pumps are easy to take apart for inspection without removing the pipe connections: simply remove 3 bolts.

Vapor Spray Degreaser

Circo Equip. Co., Dept. MF, 51 Terminal Ave., Clark (Rahway), N. J.

A new compact circular vapor spray degreaser has been designed for operating economy and convenience.

In addition to unique circular construction which reduces floor space requirements, increases accessibility and simplifies servicing, Model OP2-D30 features unobstructed tank walls with recessed condensate trough for effective solvent reclamation. This trough serves as a reservoir for distilled, pure solvent which is fed by means of a leak-proof and corrosion resistant pump to a flexible hose and spray lance with fan-type nozzle.

Interior of the standard tank, as well as other critical surfaces, are zinc metallized for protection against corrosion. Stainless clad steel construction

is available for greatly increased service life. Other advantages include use of galvanized pipe and fittings; easily removable, sturdy work rest; comfortable work height and removable cleanout door. All seams are electric arc welded and exteriors are painted in solvent resistant machinery gray.

The new economy model vapor spray degreaser is available with steam or electric heating systems and includes a liquid sump safety thermostat on the electric unit. Guaranteed for one year against defective parts, materials or workmanship, the unit is operationally tested before shipment and is delivered complete, ready for installation. Details on request.

Surface Active Agent

The Johnson-March Corp., Dept. MF, 1724 Chestnut St., Philadelphia, Pa.

A new anionic surface active agent, known as Isomal 265. is a concentrated sulfonated ester type liquid with exceptional characteristics. It can be used to remove grease, oil and moisture from all types of metal surfaces. In fact, it can serve as an efficient cleaning agent for all types of polishing, cleaning and buffing. And it. can be used in the manufacture of cleaning compounds, according to claims.

It is reported to have a broader range of solubility in water and nearly all organic solvents than ever before possible with any surface active agent. It is easily dispersed in alcohol, acetone, petroleum solvents, oils and chlorinated solvents in practically any type of application.

Clear in appearance, the product has a neutral pH factor and a specific gravity of 1.088 at 60°F. It is approximately 65% active and mildly pleasant in odor.

High operating efficiency is obtained from a unique balance of lipophilic and hydrophilic elements. The solution is compatible with both non-ionic and other anionic agents. It is stable at elevated temperatures (up to 210°F.), and has no upper or lower cloud point. The product is available in 55-gallon steel drums.

Flowmeter

Industrial Development Labs., Inc., Dept. MF, 17 Pollock Ave., Jersey City 5, N. J.

The Electro-Caloric Flow Meter has been developed for the measurement and control of the mass rate of flow of liquids. In this revolutionary instrument the rate of heat transfer through the boundary layer of a liquid is utilized to obtain a measurement of flow.

The instrument is especially suited for corrosive fluids and gases, slurries, etc. It meets the most stringent safety requirements and its linear scale covers a wide range of flows including pulsating ones. The measuring elements are not exposed to the fluid and there is no pressure loss nor danger of clogging.

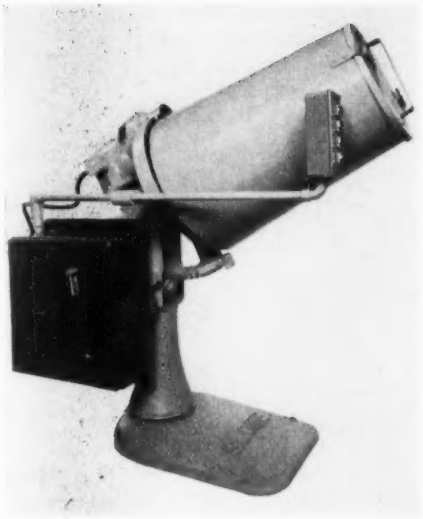
For remote indication and control, a directly produced electrical signal is available. The device is fully electronic without mechanically moving parts. Maintenance, cleaning and service problems are practically non-existent. It is designed for continuous heavy duty operation and doesn't require any adjustments. The flow indicating instrument has a 16″ long scale which is very easy to read even at relatively wide range. The flow totalizing instrument is the familiar convenient watt-hour meter. The power consumption is under 100 watts.

The instrument is housed in a very attractive gray hammertone finished cabinet (22 x 10½ x 15″) and is also available in splash- and fume-resistant and/or explosion-proof enclosures.

Power Tilt Tumbling Barrels

Globe Div., Casalbi Co., Dept. MF, 545 Wayne St., Jackson, Mich.

The Model DM-PT series is the newest in the line of Globe tumbling barrel equipment which has served industry since 1902. The new model is engineered for versatility and oper-



ator convenience. The power tilt provides easy loading, rinsing, and unloading. Push button control starts, stops and regulates up and down movement.

Cubical content ranges upward to 23 cubic feet and maximum load capacity of the largest barrel is 1,500 lbs. All 5 models are available with round, octagonal or flask type shells, made of hard maple or steel (with or without Neoprene lining).

Optional electrical equipment meets latest J. I. C. specifications. All models are available with variable speed motor.

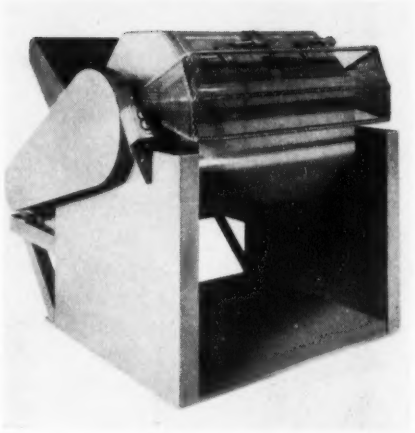
Barrel Finishing Media

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

A new barrel finishing media, conical ceramic shapes called Ceramicones, is claimed to make it possible to barrel finish intricate parts which previously could not be finished in this manner because of lodging problems.

The tapered ends of the media permit access to holes for deburring, yet the broad bases prevent lodging; and the cones' resistance to wear enables them to maintain their original dimensions over a long period of time, according to the company. The media will also remove burrs and parting lines from molded plastic parts without scratching the fine surface produced in molding.

The cone-shaped media minimizes the dangers of contamination because the ceramic material is fused under high pressure to eliminate voids and resist deteriorating effects of acids. The



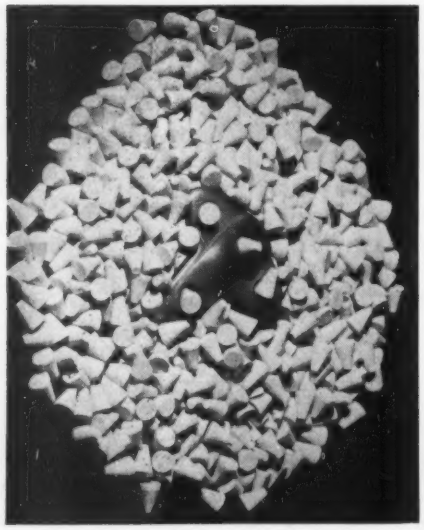
diameters are 30 and 36 in.; barrel lengths run from 16 in. up to 5 ft.

These barrels are built to withstand long runs under severe operating conditions. Ruggedness, dependability, safety and ease of maintenance were the prime considerations in the design. The oversize Reeves motor drive is powered by a NEMA-type motor of 1½ to 7½ hp. Controls, manufactured by Allen Bradley, include forward, reverse, off and jog switches, arranged in a watertight mounting. A 24-hour timer is available as optional equipment.

Heavy-duty pillow blocks give troublefree service. All lubrication points are easily accessible. Drum can be readily removed from the frame, and the drum height is arranged for easy inspection of the drum in any position. There are no overhead obstructions that can be damaged by a hoist pan, and no bulky end supports to get in the way of the operator.

A built-in transformer supplies 110 volts to the control switches. The reversing across-the-line starter is protected against overload. Screen guard is electrically interlocked to protect the operator; drum cannot be accidentally moved while the guard is open. On all two-compartment barrels, two separate screen doors are furnished in addition to the two watertight doors.

cones are ½" high, ⅜" through the base and 7/32" across the top. Be-



cause of the cone-shape, there is a surface on the media for reaching virtually every surface on the work piece.

The product is available nationally through distributors of "Honite" brand materials and equipment. Small parts for test processing, or requests for further information, may be sent to the above company.

Tumbling Barrels

Lord Chem. Corp., Dept. MF, 2068 S. Queen St., York, Pa.

The Lorco 300 series of heavy-duty barrels is built for precision finishing of large-quantity loads weighing from 700 to 3,800 lb. The line includes six octagonal barrels, one and two compartments, ranging in total capacity from 6.9 to 36.6 cubic feet. Barrel

Solvent Still

Tect, Inc., Dept. MF, Cortland Ave. and Erie St., Dumont, N. J.

A new completely automatic still for reclaiming Vythene and other Tecsolv safety solvents is now available through distributors.

The device is described as a "Teeter Still," since it operates on a unique principle of maintaining the correct operating level in the boiling chamber by a balancing princple. (Pat. pend-

ing). This eliminates the problems of operation with float type controls which require frequent cleaning and may be readily rendered inoperative by a deposit of sludge on the shaft of the float.

The still is also provided with an additional balancing control which shuts off the equipment when distillation has been completed. Another automatic device will halt operation when oil concentration is so great that the still requires draining of the sludge.

The Model 82 may be set up in any plant, distills 5 to 7 gallons of solvent per hour at an operating cost of approximately 2c a gallon. Savings of 50% to 75% can thus be effected, enabling the industrial user to replace inflammable petroleum solvents of inferior cleaning ability with safety solvents at little or no additional operating cost, it is claimed.

The boiling chamber and condenser of the still are constructed of solid stainless steel for long life. The device requires only 20 amps of 230 volt AC current and a supply of tap water, using ordinary garden hose for both supply and drain. Owing to its many automatic features, it may be kept in operation 24 hours a day without fear of failure.

A single 55 gallon drum of contaminated solvent placed on a drum rack may easily be connected to a coupling and hose provided with the still. It is then pumped as required into the boiling chamber with a bronze pump operated by an electric motor mounted on the stand. The clear, recovered solvent then flows by gravity into an empty drum. Storage tanks may, instead, be connected to the still, or the device may be attached directly to an open tank used for cold cleaning, if desired.

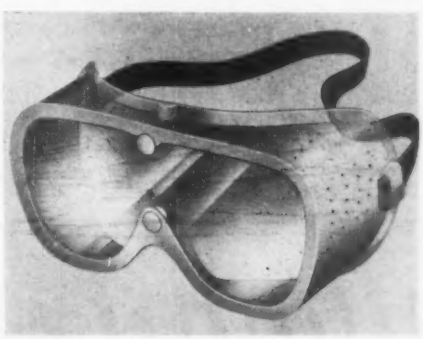
Safety Goggles

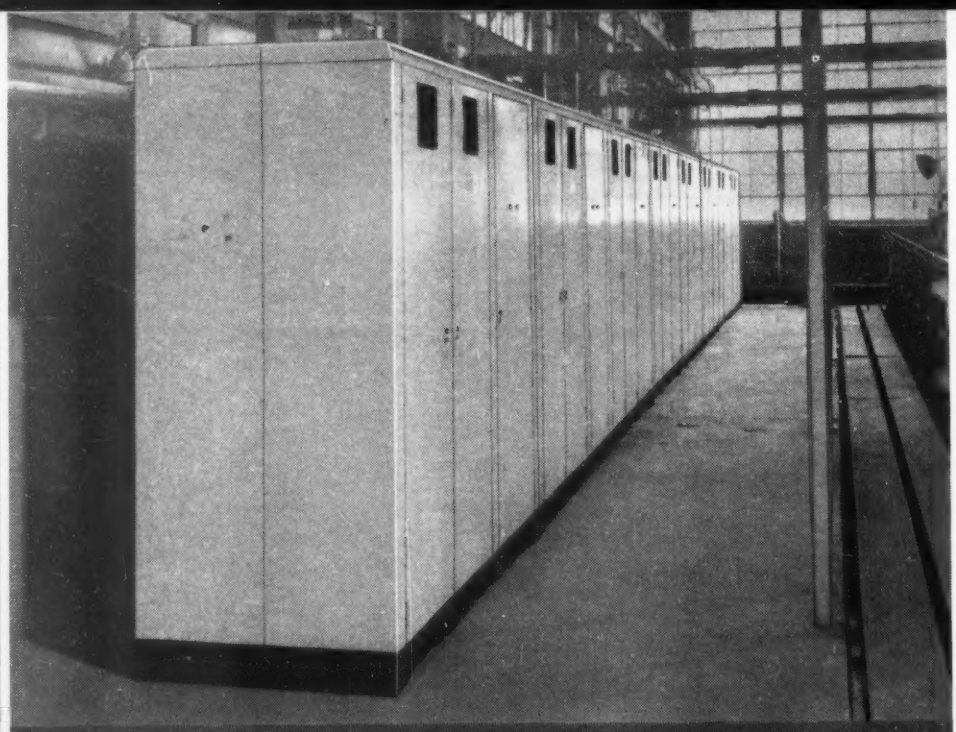
Welsh Mfg. Co., Dept. MF, 37 Magnolia St., Providence, R. I.

New, "soft side," single lens, safety goggles offer long wearing comfort, provided by soft, pliable, vinyl plastic frame in crystal clear or green. The goggle adapts readily to any size or shape of head. Deep frame design gives greater clearance over prescription spectacles and fits snugly along temples.

Single piece, extra large, clear or green lens of impact resistant cellulose acetate provides unobstructed, wide angle vision and a vinyl lens is available for chemical operations. Two positive snap fasteners make lens replacement easier and quicker.

Further information may be obtained by writing to the above address.





UDYLITE PROVES GERMANIUM EFFICIENCY FOR ELECTROPLATING

48,000 amperes at 12 volts used for nickel plating

The eight liquid cooled germanium rectifiers installed by Udylite and used by the Hilfinger-Jackson Corporation provide the 48,000 amperes at 12 volts required for nickel plating in the Udylite Full Automatic Plating Machine.

This first operation of liquid cooled germanium rectifiers for electroplating was carefully studied for proof of economy. The calculated efficiency and the resultant savings were weighed against the cost of the installation. The unmatched efficiency, the unvarying life of the cells, and, with these liquid cooled units, the elimination of the ventilation requirement, swung this decision to germanium.

Udylite furnishes air cooled germanium rectifiers. Air cooled units range from 1000 to 6000 amperes—6-24 volts. Liquid cooled units—4000 amperes or more and up to 24 volts.

Udylite also builds selenium rectifiers of highest efficiency. Whatever your power requirements may be, it pays you well to investigate the Udylite Selenium and Germanium Rectifiers.

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER

Udylite Overseas

Gothenburg, Sweden

In Sweden nickel plating is the predominant electroplating process, and bright nickel plating is used as much as possible.

Bright Nickel plating was introduced into Sweden in the thirties when the first so-called bright nickel plating solutions were imported from Germany.

During the second world war the supply of nickel for decorative nickel plating purposes was practically nil, and very little nickel plating was carried out. Research on bright nickel plating was, however, being done and it was possible to formulate one or two bright nickel processes.

When the war was over, and nickel became available again, it was quite clear that organic bright nickel was the answer to many nickel plating problems.

The conditions for the successful exploitation of the Udylite processes were thus given, and it was also possible to get the main share of the bright nickel plating business in Sweden.

Blasberg, Germany

During the few months since the introduction of Zero-Mist into Germany we can definitely state that daily, there is increasing interest in this aid to the plating trade.

From practical experience we can confirm that the saving of chromic acid, resulting from elimination of losses from extraction and dragout, adds up to 70% and in many cases even more.

Helsingfors, Finland

The light metal industry making consumable goods which require high class surface treatment has only during the last few years become more common in Finland, this depending mainly upon the fact that the export of this kind of article has been difficult lately, due to currency difficulties.

Plating plants, especially those carrying out jobbing plating, were competitive and are still competitive in price.

The high salaries and overheads and the fact that a mechanised sequence reduces the reject percentage have made it clear to our customers lately that an automatic plating plant is the working method to which we have to strive.

Nowadays about 50% of the nickel plating baths in our country are Udylite bright nickel baths.

Bienne, Switzerland

Brycad Cadmium: Practical trials on a large scale at one of our more important machine factories have shown that the physical characteristics obtained, whether from the passivated deposit or not, were better than in other deposits obtained in Switzerland. It even seems that the chemical resistance is slightly superior to that of deposits of cadmium from normal baths.

Udylite Overseas

Brussels, Belgium

We have already made a start in Belgium with conversions of Udylite No. 31 bright nickel baths to 514. Reactions have been favourable with regard to brightness, better coverage and a whiter nickel deposit.

We have also launched the new Brycad Cadmium in Holland and in Belgium. It does seem that the improvement of Brycad is appreciable in comparison with the old process. One of the undoubted advantages is the fact that the brightness is sufficient for commercial use and that after-treatment can be caried out in more dilute solutions with the result that the minimum of the metal deposited is removed.

Copenhagen, Denmark

In Denmark trials were recently made with bright nickel plating in conjunction with abrasive belt polishing at the largest vacuum cleaner factory in this country.

The parts to be plated were steel tubes, which are shaped for various applications. The method hitherto used by the factory has been handpolishing followed by dull nickel plating and a finishing operation on the nickel deposit.

The treatment suggested by us was as follows: Centerless wet polishing with abrasive belts, forming operations, followed by direct bright nickel plating without any intermediate hand-polishing or finishing.

Though the brightness of the nickel deposit with the Udylite 31 bath was considered to be fairly good, an appreciable removal of the grit marks proved to be impossible with the deposit of 9 microns.

A few centreless polished and formed parts were nickel plated by the new No. 514 process. The finish of these samples showed a surprising improvement compared with the first tubes, both as regards brightness and also line removal.

The customer in question is satisfied with the results and is to start nickel plating his tubes by the 514 process.

Barcelona, Spain

Sociedad Espanola de Automoviles de Turismo, S. A., which is producing in Spain under F.I.A.T. licence the well known 1,400 automobile, has recently introduced into its equipment the largest bright nickel installation existing in this country. During the last two years this firm has been using two bright nickel units for small parts bulk plating and a set of barrels for Udylite Bright Nickel plating.

In view of the results obtained with the two bright units, the Company decided to substitute their Watt nickel baths, each one of a 6,000 litre capacity, by the Udylite bright nickel bath in spite of the big investment implied in the modification.

"Sampler" of Rubber and Plastic Lining Compounds

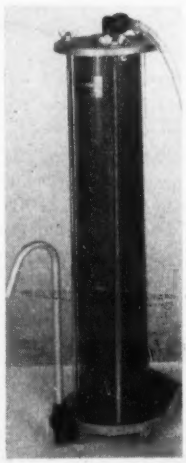
Automotive Rubber Co., Inc., Dept. MF, 12550 Beech Road, Detroit 39, Mich.

A unique sampler of a wide variety of ARco rubber and plastic lining compounds, proven in many years of industrial use, was recently released.

The sampler is a 3½" x 8½" folder carrying eleven actual specimens of rubber and elastomeric materials compounded, milled, and calendered in the firm's mills. The specimens represent standard compounds used in the majority of corrosion and abrasion resistant lining work performed by company engineers and technicians.

Demineralizer

The Kutlir Laboratories, Dept. MF, Monmouth Junction, N. J.



Capicity of the B-173 Chemi-Filter demineralizer is 1,000 grains. Thus, if the inlet water contains 4 grains per gallon, 250 gallons will be demineralized between resin bed replacements.

The effluent is of exceedingly high purity, having electrical conductance of 1 to 2 million ohms. The resin bed is self-indicating, changing color as it is being exhausted so that the operator can tell at a glance when he needs to replace his resin bed.

The resin beds are expendable and

the replacement resin beds are relatively inexpensive.

Solution Conductivity Control

Fielden Instrument Div., Robertshaw-Fulton Controls Co., Dept. MF, 2920 N. Fourth St., Philadelphia 33, Pa.

A new electronic instrument for controlling the conductivity of solutions is claimed to fill the need in industry for a low cost solution conductivity controller where recording is not required.

Designed for simplified use and operation, the controller is equipped with two zone action for both alarm or control. A single set-point knob on

the front provides control within the range of the instrument calibration. It is available in two standard ranges of conductivity: 0 to 30 micromhos/cm³, or 20 to 200 micromhos/cm³, for use with conductivity cells having a constant of one. The scale calibration is non-linear and provides maximum readability at high specific conductivities.

Accuracy of the instrument is ± 0.5% of full scale, and it has a sensitivity of ± 0.1% of full scale, exclusive of the cell and temperature compensator. In solution temperature changes between 20°F. and 100°F., automatic temperature compensation limits the maximum error to ± 2% or ± 5% of full scale.

The instrument is contained in a small compact rubber gasketed, cast aluminum case, 6½" wide, 7½" high and 4" deep. Two indicating lights, red and green, are built into the case to show whether the controlled variable is above or below the set-point. A special fail-safe feature of the instrument will indicate a high specific conductivity condition upon failure of a vacuum tube or power supply, shorted cell, etc.

The controller is available with

various types of conductivity cells, depending upon the application. The standard compensating bulb is provided with a 316 stainless steel sheath.

Standard Wire Baskets

Charles Wm. Doepke Mfg. Co., Inc., Dept. MF, 8874 Blue Ash Road, Rossmoyne, O.

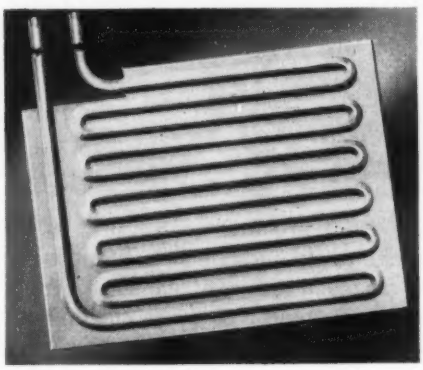
The above manufacturer has announced the addition of wire baskets to its NesTier line of parts handling equipment. Number of standard sizes offered, according to the company, is one of industry's largest, ranging from 18" x 10" x 3" to 24" x 14" x 12". In addition, facilities are available for fast, economical design and production of special baskets and inserts to meet individual requirements.

Particularly adapted for handling fragile or highly finished parts, these wire baskets are also recommended for use when parts within a container need to be positioned for easy withdrawal for production or assembly operations.

To insure proper annealing of welds, the baskets are welded on special machines equipped with automatic controls. Regularly furnished in bright basic steel wire, they are also available in other materials, including stainless steel. A variety of wire sizes is offered, ranging from No. 16 to ½". The baskets can be supplied zinc plated or finished in a variety of plastic coatings. Either nesting or stacking designs are available, with fixed or movable handles.

Platecoils

Tranter Mfg., Inc., Platecoil Div., Dept. MF, Lansing 4, Mich.



A new line of platecoils features serpentine construction and "at-the-top" connections.

Platecoils are heat transfer units designed to replace pipe coils in industrial processes requiring the application or removal of heat. They consist of two embossed metal sheets welded together to provide a preformed channel for the flow of heating or cooling media.

The right-angle inlet and outlet fittings on the Style 50 platecoils make them especially suitable for use in open top tanks. They can be quickly hung in position, with all threaded connections above the solution level, permitting quick, easy removal for cleaning or inspection without draining the tank. The serpentine layout of the channel provides continuous, in-line flow of the heating or cooling media.

The new platecoil is available in 18 or 22-in. widths, and in lengths from 23 to 119 inches. Over-all thick-

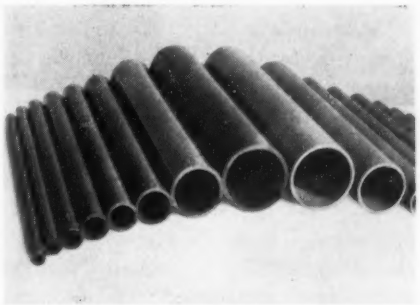
ness is 7/8 inches. Metals available are: cold-rolled steel, stainless steel and other alloys for corrosive solutions.

Plastic Pipe

Alloy Tube Div., Carpenter Steel Co., Dept. MF, Union, N. J.

Two types of unplasticized PVC (polyvinyl chloride) pipe, a normal impact grade with high chemical resistance, and a high impact grade with slightly less chemical resistance but much greater strength, are designated Carpenter PVC No. 1 and Carpenter PVC No. 2, respectively. Threaded and socket types of fittings are available.

Both types are easily fabricated on standard metal and wood-working equipment. They can be formed, sawed, threaded, machined, hot gas welded and solvent cemented. Installation is simple and inexpensive.



The pipe is available in Schedules 40 and 80 in nominal sizes ranging from ½" to 4". All pipe is furnished in standard 10 and 20 foot lengths with plain ends.

Drum Lift

Sterling, Fleischman Co., Dept. MF, Broomall, Pa.

A new, improved drum lift enables one man to handle steel drums (55 and 30 gal.), fibre drums (18" to 23" dia.), and acid carboys (13 gal.).

Sturdy, of all-steel construction, the drum lift is rated at 750 lb. capacity. Lifting power is supplied by a foot-operated hydraulic jack. Drums can be raised for pouring to a height of 53". They may be stacked two-high vertically. The center of gravity of the drum is always maintained within the four casters, making it impossible for the lift to overturn.

Four-inch oil, gas, and spark-proof roller-bearing casters are normally supplied to move drums easily from one location to another. Eight-inch diameter or spark-proof conducting casters can be supplied on special order.

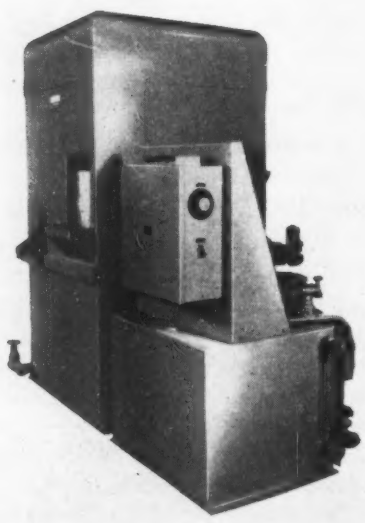
An outstanding feature of the lift is the easy-lock girdle which grips the drum firmly, is attached in a matter of seconds, and permits 360° drum rotation. It allows the user to lift a drum safely and easily from floor for pouring, stacking, or rotating to mix contents. Brakes on the drum-lift arms hold drum at any angle.

Vibrating Solvent Degreaser

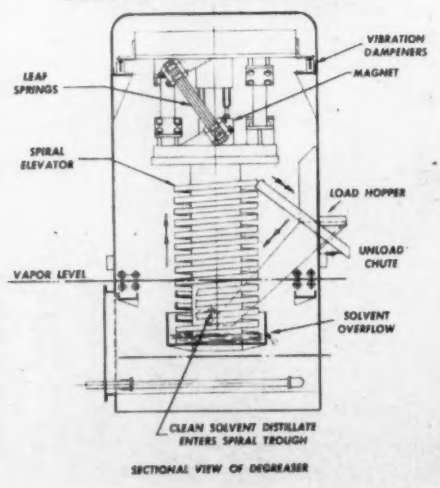
Manufacturers Processing Company, Dept. MF, 1360 Hilton Road, Detroit 20, Mich.

Vibra-Degreaser Model MSS-321 is said to move small parts and chips in a "corkscrew", circular uphill action, passing parts through a liquid immersion, liquid rinse, and solvent vapor zone. It then emits clean metal materials through an unload chute located 42" from ground level.

The unique action of the degreaser



MANPRO VIBRA-DEGREASER



SECTIONAL VIEW OF DEGREASER

involves, first, loading parts to be cleaned into a synchronized hopper, a component of the machine. Parts descend to a pan at the bottom of the spiral trough and then start their progress upward in the trough until they reach the unload chute.

This action is made possible by a combination of flexible, vibrating leaf springs and electromagnets to which the spiral trough is attached. This assembly is energized by a pulsating current creating the vibration that transports the work through the cleaning cycle and on to the unload chute.

It is claimed that the new unit is capable of cleaning up to 3,000 lbs. of chips or metal parts per hour, while requiring floor space of no more than 5′ x 5′. Company engineers state that this unit can be synchronized to perform with conveyor and automation systems because it is fully automatic. The unit can be fed by one conveyor and be synchronized by a selector to discharge on to another conveyor, or the machine can be operated as a batch-type unit.

The loading and unloading chutes on the degreaser can be positioned to work from any side of the machine as may be required in a particular operation. The unit is completely enclosed except for the small openings where parts are loaded and unloaded. This keeps the trichlorethylene loss at a minimum.

The MSS-321 model degreaser is of heavy-duty, all steel, welded construction. Shipping weight is approximately 4500 lbs. The solvent capacity (original charge) of this unit is 85 gallons.

Floor Surfacing

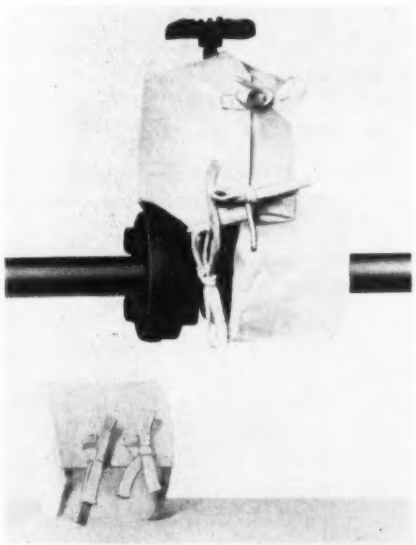
Plant Maintenance, Inc., Dept. MF, 623 Green Road, Cleveland 21, O.

Poly-Rock, a new floor surfacing, is claimed to be more resistant to acids, oils, solvents and water than any material known to this date. The material is claimed to be insoluble in all organic and most inorganic acids in common use. The product contains no asphalt, cement, latex, or other similar ingredients found in most floor surfacing materials. It is produced in a non-slip form and withstands considerable abrasion, equal to most concrete surfaces. Even though applied in a thin layer by trowel, its toughness in protection of the floor base is considered outstanding.

In addition to the above qualities, one of the great features of the material is its speed and ease of application without expensive floor preparation, equipment or lengthy shut-down periods. In spite of the product's vastly different composition, combined material and labor costs are considerably lower than other methods. It can be easily applied by plant crew or contractor in small areas at a time and used within 12 to 24 hours. It is applied over a new or existing base of concrete, wood or brick.

Universal Valve Covers

Neirad Industries, Inc., Dept. MF, 1 Post Road, Darien, Conn.



A universal line of Spray-Stop valve covers having only eleven different sizes, and which replaces the 142 different sizes previously required for valves, has recently been developed.

All of the company's valve cover products, which prevent sudden leaks from jetting onto personnel and equipment, Non-Indicating, Indicating (the only cover that gives rapid warning of leaks by a vivid change in color), and Teflon (for high temperature) are now available in the new universal design.

Two-Stage "Canned" Motor Pump

Chempump Corp., Dept. MF, Station J, 1300 East Mermaid Lane, Philadelphia 18, Pa.

The new 3-horsepower Series DE (Double-Ended) Chempump is the latest addition to company's line of "canned" motor pumps for leakproof handling of corrosive, toxic, hard-to-handle liquids. Basically a two-stage pump, the pumping chambers can be piped in series (shown) or parallel for remarkably compact high head or high volume pumping. Overall size of the pump is less than 2′ x 1′ x 1½′, yet it gives heads to 230 feet.

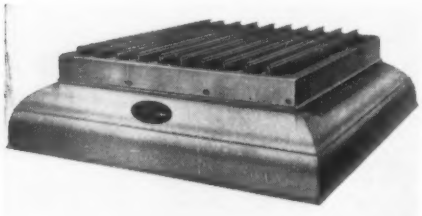
The new pump is available in cast iron, cast steel, 300-series stainless steel, Monel and Carpenter-20. Standard temperature and pressure limits are 450°F. and 300 psi. respectively.

Roof Exhauster

Iron Lung Ventilator Co., Dept. MF, 5403 Prospect Ave., Cleveland 3, O.

The AlumaLung's design is completely functional, being built entirely of heavy wall, extruded aluminum sections. No part of it is formed from light gauge sheet metal. All joints are welded and because of its light weight, even the largest exhauster can be hoisted and installed by two men without special equipment.

The overall height is only 21 inches.



It becomes invisible behind parapet walls and the attractive simplicity of its design causes it to blend with any style of architecture.

The exhauster is leak-proof, with dampers open or closed, even during severe storms, according to the above manufacturer and is available in the following sizes: 20"-24"-30"-36"-42"-48"-60"—and in capacities from 3,800 cfm. to 42,000 cfm.

NEW BOOKS

Chemical Trade Names and Commercial Synonyms

By William Haynes. Published by D. Van Nostrand Co., Inc., Princeton, N. J. 1955. Price: $8.00. 456 pages.

In this second edition, the author has increased the entries by more than one-quarter, to identify about 20,000 items used in chemical industry. The index includes common names, proprietary names, and a list of products identified by numbers, with the proprietary names predominating. Of value is the reference to the supplier of each material by name and address. This is necessary because the descriptions are necessarily quite concise and the user of this volume will have to consult the manufacturer for required information.

Listing of common chemicals could have been eliminated without detracting from the value of the book, since they are covered much more fully in any chemical dictionary and are of no help to the reader who wishes to learn if any specific chemical is sold under a proprietary name. However, omissions and inaccuracies are almost negligible and, as the latest work of this nature, the dictionary will be very helpful to users of industrial chemicals.

Organic Reagents for Metals

Edited by W. C. Johnson. Published by The Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. 1955. Price: $4.00. 193 pages plus index.

This collection of 27 monographs covers new reagents and older ones for which new methods of application have been found. More than half of the monographs have been published for the first time in this book and practical details have been carefully checked.

An exceptionally complete bibliography has been included at the end of each section, which will be of value to the chemist who wishes to investigate the methods in more detail or to modify them to solve special problems, of which a number are already included.

This volume will be helpful to the analytical chemist in speeding up his determinations of metallic ingredients in solutions.

Manufacturers' Literature

Vapor Degreaser

Circo Equipment Co., Dept. MF, 51 Terminal Ave., Clark (Rahway), N. J.

The Circo Model OPNT vapor degreaser is described in a new technical bulletin.

The unit operates in a solvent stage-vapor stage-solvent stage sequence, with continuous and automatic water removal through an efficient separator. Automatic solvent distillation and reclamation, and availability for gas, steam or electric power are detailed.

The bulletin discusses materials of

construction, mechanical features, operating characteristics and its suitability with various industrial solvents. An engineering drawing detailing inside working dimensions and overall measurements, and a data table providing complete specifications for the entire range of variations on the basic model OPNT are also contained.

Solution Filters

The Udylite Corp., Dept. MF, Detroit 11, Mich.

A bulletin illustrating and describing the Udylite-Detroit solution filters is now available. The advantages of the filters, designed by platers for platers, are given, as well as specifications.

The manufacturer will send a copy of the bulletin or additional information on request.

Polyvinyl Chloride Linings

Kaykor Industries, Inc., Dept. MF, Yardville, N. J.

How to choose the best polyvinyl chloride protection for any given corrosive environment is discussed at length in a new booklet.

The three most commonly used types of PVC protection are covered individually, attention being paid to physical and chemical characteristics, advantages and disadvantages, and the applications for which each is best suited. In addition to unplasticized polyvinyl chloride structural material, and flexible PVC lining, space is devoted to the recently introduced flexible-rigid polyvinyl chloride laminates, which combine the inertness of the unplasticized with the easy application of the flexible types.

Contract Plating

Jamestown Electro Plating Works, Inc., Dept. MF, Jamestown, N. Y.

The above firm, which does custom plating to specifications, has issued an eight page, illustrated brochure showing its growth through the years and present facilities.

Tanks and Linings

Perma-Line Rubber Products Corp., Dept. MF, 1753 N. Winnebago Ave., Chicago 47, Ill.

The above firm has issued an eight page, illustrated brochure on its line of tanks and tank lining service. Included are the various types available, a list of industries where they are used, and a chart showing the need for a variety of linings.

Industrial Waste Treatment

Graver Water Conditioning Co., Dept. MF, 216 W. 14th St., New York 11, N. Y.

Technical Reprint T-145 on "Specifying Industrial Waste Treatment" presents a comprehensive picture of this increasingly important field. There is a discussion of the proper steps to be taken in approaching the problem, the methods of treatment and the types of equipment used to accomplish given tasks.

Barrel Finishing

Lord Chemical Corp., Dept. MF, 2068 South Queen St., York, Pa.

"The Lorco Method of Precision Barrel Finishing for Metals and Plastics," available from the above firm at 50 cents per copy, tells how to tumble to get the best results and effect maximum production savings. Simple, basic techniques, developed around a series of 27 chemical compounds, used with or without fused aluminum-oxide chips and other media, are described.

Two of the six chapters cover general procedures for metal parts, ferrous and non-ferrous; a third chapter is devoted to the new technique of barrel

finishing of plastic products. Much of the material in this chapter is based upon original research studies and has never before been described in print, it is claimed.

The remaining three chapters are devoted to compounds and their specific purposes: media, including all-purpose fused aluminum-oxide chips, aluminum-oxide abrasive spheres and triangles, steel shapes, etc.; and the equipment needed for precision barrel finishing. The latter chapter pictures and describes barrels in a wide range of sizes and such necessary accessories as screen-type and magnetic-type separators, bins for chips and compounds, centrifugal dryers and a universal tumbling rack. A layout for a tumbling department is included.

Bright Nickel Plating

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

An illustrated 20-page instruction manual describes the three techniques for electrodepositing by the Nickel-Lume process: Type I, for use in still tanks or with conveyors where work loads are in mild motion; Type II, for use with air agitation; and the barrel process for plating in cylinders.

The manual explains the proper bath preparations for these processes, the converting of existing baths, and the effect of the important constituents. Solution maintenance, purification, handling of equipment and materials are discussed. Analytical procedures, for all of the constituents, including the addition agents, are outlined.

Plating of special equipment such as marine hardware, automobile bumper guards, surgical instruments (which can be sharpened after plating), electric irons, toasters and grills which must retain their bright finish after extreme temperature changes, is fully described and illustrated.

Field Studies of Corrosion Proofing

Pennsylvania Salt Mfg. Co., Dept. MF, Three Penn Center Plaza, Philadelphia 2, Pa.

A new brochure on corrosion proofing materials and techniques contains detailed information on cement mortars, interliners for masonry construction and protective coatings and linings for surface treatment.

The 8-page illustrated booklet contains sections describing the various Pennsalt materials for corrosion proof masonry construction and techniques for application based on studies of thousands of corrosion-proof masonry installations laid up in cement mortars over periods of 10 to 20 years. Installations surveyed include linings in acid concentrators, stacks, pickling tanks, brick and tile floors, as well as sumps, pits and trenches for handling industrial wastes. Tables and charts are provided for selecting proper cement mortars and determining resistance to various corrosive conditions.

A section describes surface applications of protective coatings and linings. Charts are provided for general use in selecting the firm's coatings or linings suitable in various corrosive ranges.

Conductive Coatings

Micro-Circuits Co., Dept. MF, New Buffalo, Mich.

A 9-page manual, No. M31, discusses use of electrically-conductive coatings in research, development, and design. Although detailed techniques and specific paints are suggested, the discussion is presented in sufficiently broad terms, so that scientists and engineers in essentially non-electrical fields will find many useful applications. As a result, it will prove to be a useful reference for workers in nearly every field of science.

Presentation is by discussion of ten, basic, new approaches to the solution of problems in many widely different fields.

Pocket Tumbling Units

Tumb-L-Matic, Dept. MF, 4510 Bullard Ave., New York 70, N. Y.

An illustrated data sheet, Bulletin No. MP-55, describes multiple pocket units of tumbling barrels for small scale deburring, definning, precision surface finishing, and burnishing.

Photographs show both the submerged type, for wet processing, and the self-contained type, for wet and dry processing of small quantities of parts.

The advantages of pocket tumbling units are outlined in the data sheet. The possibility of nearly continuous batch operation, using interchangeable barrels, is explained and illustrated.

Construction details are given for both types of tumbling units, and a table is provided showing structural dimensions and floor space requirements for all models.

Metal Finishing Services

J. W. Rex Co., Dept. MF, 834 West 3rd St., Lansdale, Pa.

A new booklet, "Chemical Finishing of Metals," contains information to help design engineers and purchasing agents find new ways to cut manufacturing costs through substitution of low-cost, treated base metals and replacement of expensive plating operations.

Useful for design and reference, the booklet describes aluminum anodizing, surface conditioning, and various other types of conversion coatings obtainable on aluminum, magnesium, and steel.

Condensate and Vacuum Pumps

Sarco Co., Inc., Dept. MF, Empire State Bldg., N. Y. 1, N. Y.

The new Type S condensate pump and the above manufacturer's complete line of vacuum and condensate pumps are described in a new 28-page bulletin No. 1465. The reader will appreciate the large cut-away illustrations, the pump selection guide and the installation diagrams.

Potassium Cyanide Solution

Chemical Div., Koppers Co., Inc., Dept. MF, 1301 Koppers Bldg., Pittsburgh 19, Pa.

A new 4-page bulletin, C-6-227, describes the above manufacturer's potassium cyanide solution for use in electroplating applications. Specifically, the product is presented in the light of its economy, purity, ease of handling, safety, and quality control.

Designed to be of information to small, as well as large, plating operators, the new bulletin lists the applications of the product to the plating of automotive parts, appliances, silverware, surgical instruments, hardware, tools, and ball bearings, and certain custom plating operations.

Industrial Waste Treatment

Milton Roy Co., Dept. MF, Station L, 1300 East Mermaid Lane, Philadelphia 18, Pa.

Technical Paper No. 64 presents several practical systems for process and waste water treatment utilizing controlled volume pumps to meter chemicals and additives. In the area of water treatment, such processes as coagulation, clarification, boiler water treating and oxygen scavenging by hydrazine addition are discussed in detail.

Waste treatment systems in plating, mills, aircraft plants and metal fabricating plants, are also illustrated and analyzed.

Water Stills

Barnstead Still & Sterilizer Co., Dept. MF, 2 Lanesville Terrace, Forest Hills, Boston 31, Mass.

A new forty-eight page catalog provides comprehensive technical inform-

See Cowles NS and QC advertisements on pages 83 and 103.

ation on the complete range of the above firm's water stills, from the well-known laboratory models to the large industrial units producing thousands of gallons per day.

An outstanding feature of this handsome and detailed catalog is the seven-step, pictorialized description, "How a Barnstead Still Operates." Description of automatic controls and operating controls are also included.

Concise descriptions, numerous photographs, clear, readable tabulations make this unusually useful and essential reference book for anyone who uses distilled water, whether it's for large-scale production operations, industrial research projects, or important laboratory work.

Corrosion-Proof Cements

Atlas Mineral Products Co., Dept. MF, Mertztown, Pa.

A recently released, revised 12-page bulletin on corrosion proof cements, Bulletin No. 5-2, brings the latest technical data on five standard cements: furan, phenolic, sulfur, polyester and silica based materials.

Chemical Recovery by Ion-Exchange

National Aluminate Corp., Dept. MF, 6216 W. 66th Place, Chicago 38, Ill.

In many cases, ion-exchange resins can be used to purify and recover chemicals such as chromic acid. Disposal of toxic wastes can be alleviated by proper use of ion-exchange. Such treatments are both practical and economical.

Literature on the subject is currently being offered by the above company. It describes treatment and recovery techniques for anodizing and chromium plating solutions. Still and running rinse solutions are deionized and recovered.

Shop Hints on Barrel Finishing

Rampe Mfg. Co., Dept. MF, 14915 Woodworth Ave., Cleveland 10, O.

A brief handy shopman's guide removes mystery from barrel finishing—outlines six basic essential operating conditions as size and type of abrasive stone or burnishing balls, load height, speed of rotation, amount of water, ratio of work parts to burnishing balls, and time. Also on this sheet are listed new barrel finishing compounds.

The literature gives a chart of uses for each compound, quantity usage and prices in various standard containers.

Use of Abrasive Rolls

American Abrasive Products, Inc., Dept. MF, P.O. Box 494, Dayton, O.

Bulletin F-29 describing in detail the use of abrasive rolls for deburring, polishing, and for preparing metal and plastic parts for organic finishing is now available on request.

Metal Cleaners

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

A new four-page bulletin, No. C-108, on the application of Matawan cleaners in preparing metallic surfaces for electroplating, anodizing, painting and other decorative or protective coatings explains the different types of metallic cleaning processes: soak cleaning, electrocleaning, barrel cleaning, spray washing machine cleaning, and specific purposes cleaning. A reference chart is included, showing the proper cleaner and process to be used with aluminum, brass, copper, steel, lead, magnesium, tin and zinc.

Vapor Spray Degreaser

Circo Equipment Co., Dept. MF, 51 Terminal Ave., Clark (Rahway), N. J.

New literature is available describing the Circo OP2 vapor spray degreaser, a new basic model for metal

cleaning operations available in various corrosion resistant combinations and with gas, electric or steam heating systems.

The folder contains photographs, a dimensional drawing and complete specifications for the degreaser as well as an outline of important operational and mechanical features.

The operation, construction, heating means and solvent-vapor-solvent cleaning cycle are explained. Also discussed are the firm's drummed trichlorethylene and perchlorethylene degreasing solvents commercially supplied for this and other standard metal parts cleaning equipment.

Electric Indicating Temperature Controllers

Sarco Company, Inc., Dept. MF, Empire State Building, N. Y. 1, N. Y.

Completely revised bulletin No. 1025B describes the LSI Electric Indicating Temperature Controller. A simplified operational sketch shows how this versatile LSI can be used to provide sequence control combinations such as: step-heating, heating and cooling, wide differential control, holding and operating temperatures, and also temperature control plus operation of signal devices.

Automatic Plating Machine

The Udylite Corp., Dept. MF, Detroit 11, Mich.

The above firm has issued an illustrated bulletin on its Cyclemaster, an automatic plating machine. Complete information is given, also addresses of company representatives.

Copies of the bulletin or additional information may be obtained by writing directly to the above manufacturer at the above address.

Automatic Heating Controls

General Controls Co., Dept. MF, Glendale Calif.

A new automatic heating controls catalog contains many new items including a complete line of oil, coal and electric heating controls, plus the latest improvements and changes in the manufacturer's line of gas heating controls.

Also listed are the locations of the company's 5 plants, 7 warehouses and 42 factory branch offices operating throughout the U. S. and Canada.

Tank Rheostats

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

An illustrated four-page bulletin, No. CPR-200, on the new H-VW-M universal carbon pile tank rheostats for electroplating describes the advantages of the tank type of rheostat, which provides all tank voltages for specified line voltage and maximum amperage conditions. A standard rating chart is provided, together with instructions on how to select the proper rheostat.

Four close-up photographs show sectional and front and rear views of the control panel, and a wiring diagram is included. Dimensions of the four sizes of carbon pile tank rheostats are given, together with the shipping weights. The bulletin contains complete mounting and operating instructions.

BUSINESS ITEMS

Wagner Brothers Appoints Chief Research Chemist

Dr. Bruno Jeremias has been named chief research chemist of the Research and Development Department, *Wagner Brothers, Inc.*, Detroit, Mich. He

Dr. Bruno Jeremias

will devote all of his time to research in metal finishing processes.

Dr. Jeremias gained his Ph.D. in chemistry at the University of Heidelberg, Germany. It was also here that he received the Victor Meyer award in recognition of his outstanding work in the field of chemistry.

Following work in Germany, Dr. Jeremias went to Bolivia in 1939, where he was associated with the vast mining company, Mauricio Hochschild S.A.M.I., as an analytical chemist and soon after as acting chief chemist. He came to the U.S.A. in 1946, as an officer and chief chemist of the Spectro-Chemical Research Laboratories in Chicago; later he joined the Promat Division of Poor and Co., Waukegan, Ill., as chief analyst and finally as chief chemist. In this capacity, Dr. Jeremias did considerable research on chromate conversion coatings and holds several patents in this field.

Hopkins Named Bart General Manager

William A. Hopkins

William A. Hopkins, vice-president of *Bart Mfg. Corp.*, Belleville, N. J., has been appointed general manager of the Lectro-Clad Division.

Vice-president in charge of manufacturing since 1953, Mr. Hopkins will now also be responsible for all marketing and sales functions for the firm's nickel plated steel pipe and fittings. He will also maintain liaison between his company and Wickwire Spencer Steel Division of Colorado Fuel and Iron Corp., who will act as distributors for the firm's nickel plated steel sheet and plate.

An alumnus of the University of Cincinnati where he majored in metallurgical engineering, Mr. Hopkins has held technical-executive and/or sales positions in the metal finishing industry since 1934. Employed as a plating engineer in various divisions of the Electric Autolite Co. until 1945, he joined Continental Die Casting Corp. as plant manager. He has also been associated with Gerity-Michigan Corp. as technical director, and prior to joining the Bart organization in 1952, was Detroit area sales manager for the McGean Chem. Co.

During World War II, Hopkins was associated with the Kellex Corp., in work on the Manhattan project.

Robert P. Gygli, Jr., Joins H-VW-M Cleveland Office

Hanson-Van Winkle-Munning Co.,

Matawan, N. J.. announces expansion of company coverage and service in Cleveland and central Ohio by the addition of *Robert P. Gygli, Jr.*, to the Cleveland sales staff.

Mr. Gygli graduated from University High School, Shaker Heights, Ohio,

Robert P. Gygli, Jr.

and Colgate University, Hamilton, N. Y., where he majored in chemistry. For the past four years he represented the Pioneer Electric Supply Co. of Cleveland. His Army service was with the 11th Airborne Division, Medical Detachment, with overseas service in Japan.

He is currently going through a training course at the firm's main plant in Matawan, preparatory to assuming his new duties in Cleveland.

R. G. Haskins Co. Buys N. A. Strand

R. G. Haskins Co., leading manufacturer of flexible shaft grinding, polishing, and capping equipment announces the purchase of the N. A. Strand Division of *Franklin Balmar Corp.* N. A. Strand for years has been identified with the manufacture and sale of equipment similar to the Haskins' line and as a new Haskins division will continue to serve its customers as a wholly owned, independently operated subsidiary.

E. P. Grismer has been appointed general manager of the N. A. Strand Flexible Shaft, Inc. He will continue as chairman of the board of Haskins.

Tamms Plant Has Fire

On January 29th a fire of undetermined origin temporarily disrupted silica operations at the Tamms, Ill. plant of *Tamms Industries, Inc.* of Chicago.

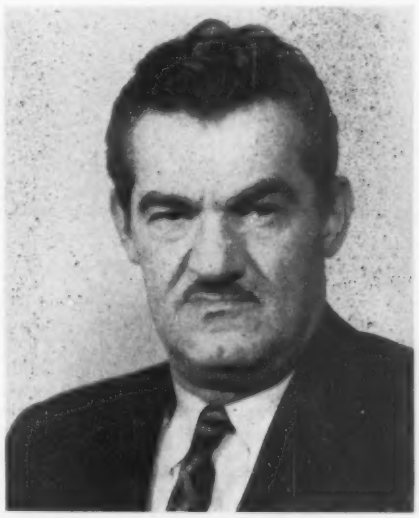
The mill supply building and machine shop were hardest hit and one grinding unit was seriously damaged. In materials, the worst loss was in empty bags and some floor stocks of processed silica for drop shipments.

Repair work was started immediately and management expected all affected units would be operating at full capacity again by March.

McAleer Mfg. Corp. Appoints Representatives

Alfred T. Berman has been named sales representative by *McAleer Mfg. Corp.*, to cover New England states. Mr. Berman has been active in the metal finishing industry since 1930.

C. F. 'Doc' Boyd was appointed



Alfred T. Berman

C. F. Boyd

sales representative in the Chicago area. Mr. Boyd, too, has been associated with finishing materials for many years.

Mohler Joins Kaiser Aluminum and Chemical Corp.

J. B. Mohler has taken a position as research chemist in the Finishing and Electrochemical Applications Branch of *Kaiser Aluminum and Chemical Corp.* in Spokane, Wash.

For the past few years Mr. Mohler has been privately employed as a metal finishing consultant, during which time he contributed a number of articles to METAL FINISHING.

Mr. Mohler holds an M.S. degree in physical chemistry from Western Reserve University in 1937. His industrial background includes experience as a research assistant with E. I. du-Pont de Nemours from 1933 to 1940, head of the Physical Chemistry Laboratory of the Cleveland Graphite Bronze Co. from 1940 to 1947 and director of research of the Johnson Bronze Co. from 1947 to 1954.

J. B. Mohler

New Appointments at Houghton

Two new appointments in its metal working division have been announced by *E. F. Houghton & Co.*, 303 W. Lehigh Ave., Philadelphia.

Sidney J. Barber was named manager of the metal working products department. He was formerly supervisor of the firm's metal working research and has been with the company for 30 years. Barber received his metallurgical training at Temple University. In his new position, he succeeds the late *James McElgin*, who died suddenly on December 7th.

Claude G. Wall, a member of the laboratory staff for 13 years, was appointed supervisor of metal working research to fill the vacancy left by Barber's promotion. Wall was graduated from Cornell University in 1942 with a B. A. in Chemistry.

Bixler Named Manager of Stokes International Division

Paul Bixler, a member of the headquarters sales staff since June, 1955, has been promoted to manager of the International Division of *F. J. Stokes Machine Co.*, Philadelphia, Pa.

Mr. Bixler, who was born in Sergipe, Brazil, was educated at Phillips Academy, Andover, Mass., and the University of Pennsylvania, where he majored in foreign trade and was

Paul Bixler

graduated with a B.S. in economics. After several years as Latin-American representative for Armstrong Cork Co., prior to World War II, he joined the U.S. Navy, serving in the Office of Naval Intelligence and for a year and a half as assistant naval attache in Caracas, Venezuela. He held the rank of Lieutenant Commander at the time of his discharge.

Returning to Armstrong Cork Co. for three years, he left that firm in 1949 to join the Eljer Co., Ford City, Pa., manufacturers of plumbing fixtures, as manager of its export department. He joined Stokes International Division in December, 1954, as a member of its headquarters sales staff.

McFadden Joins International Nickel

The appointment of *Michael C. McFadden, Jr.*, to the Central Atlantic Coast Technical Field Section of *The International Nickel Co.'s* Development and Research Division has been announced recently. The section furnishes industry with technical information and assistance relating to nickel and alloys containing nickel.

Mr. McFadden is a native of Bethlehem, Pa., where he obtained his elementary schooling. In 1947 he graduated from the University of Notre Dame with the degree of Bachelor of Science in Metallurgy. He took graduate studies in metallurgy at Lehigh University and in 1948 joined the Bethlehem Steel Co. as a laboratory investigator in the metallographic laboratory.

Before joining Inco, Mr. McFadden for more than six years was associated with the Chevrolet-Detroit Gear and Axle Division of General Motors Corp. at Detroit, Mich., attaining the position of supervisor in the Plant Engineering Dept.

He served for two years at the U. S. Naval Proving Ground at Dahlgren, Va., as a Test Officer in the Special Projects Division of the Terminal Ballistics Dept. He is a Lieutenant (j.g.) in the U. S. Naval Reserve (inactive).

Mr. McFadden is a member of the American Society for Metals and the American Foundrymen's Society.

Nicholas A. Munning Retires from H-VW-M

Nicholas A. Munning

The retirement of *Nicholas A. Mun-*

ning, vice president of *Hanson-Van Winkle-Munning Co.*, has been announced by the board of directors of the company.

Mr. Munning has served in numerous capacities during his 38 years' association with H-VW-M. He joined the firm in 1918, serving as factory manager at the Chicago branch. In 1923 he moved to the main plant at Matawan as assistant purchasing agent and served successively as assistant treasurer and credit manager. He was elected a director of the company in 1940, served as secretary for six years and became a vice president in 1952, the position he held at the time of his retirement.

General Ceramics Names Kem-E-Quip Corp. Sales Agent

General Ceramics Corp. of Keasbey, N. J. has appointed the *Kem-E-Quip Corp.* of Niagara Falls, N. Y. sales agent for their chemical stoneware and poreclain equipment in upper New York State and a portion of Pennsylvania.

Wilson Advanced by Pennsalt

Bruce W. Wilson of the *Pennsylvania Salt Mfg. Co.'s* Metal Processing Department has been advanced to the position of sales supervisor of steel and tin mill accounts.

Mr. Wilson has been with the organization since 1951 as a technical service engineer specializing in basic

Bruce W. Wilson

steel and tube drawing accounts throughout the U. S. Prior to his association with Pennsalt he was production supervisor of the Babcock & Wilcox Tube Co. in Beaver Falls, Pa. where he was employed for 14 years.

He is a graduate of Geneva College and has had additional training in metallurgy and industrial management. His headquarters are at Beaver, Pa.

Wolf Machinery Appointed as Speed-D-Burr Dealer

W. F. Wolf Machinery Co., leading Los Angeles machine tool and specialized plant equipment dealer, has been appointed by *Speed-D-Burr Corp.*, Glendale, Calif., manufacturer of precision barrel finishing equipment, as sales representative for Southern California and Arizona.

New Plastic Pipe Plant on West Coast

A new plastic pipe manufacturing branch plant is being located in Seaside, Calif., by the *Skyline Plastic Pipe, Inc.*, of Titusville, Pa.

Noel Poux, president, cited expanding sales on the West coast, and high warehouse rates and freight costs from Pennsylvania as the motivating factors.

The plant, which will manufacture all types of plastic pipe and fittings, uses polethylene, butyrate, polyvinyl chloride and other plastics.

The firm also has branch plants in France and Canada, and is surveying possible sites in South America.

Sly Mfg. Appoints Jones

Allen Jones has been named director of engineering of *W. W. Sly Mfg. Co.*, Cleveland. In addition to

Allen Jones

general supervisory duties, Jones will oversee expansion of the company's product improvement, new product development and customer engineering service programs.

Prior to the appointment, he was Chicago district manager for the firm, which manufactures dust control systems, blast cleaning equipment, tumbling mills and industrial ovens. *Harry R. LeSage*, Park Ridge, Ill., becomes the Chicago manager.

Jones' past posts include district manager for Peabody Engineering Corp., Chicago manufacturer of combustion equipment, and design engineer for Urdahl & Everetts, consulting engineers, Washington, D. C.

A lieutenant in the United States Coast Guard Reserve, Jones attended Columbia University and George Washington University. He holds a Bachelor of Mechanical Engineering degree and is a member of Delta Phi and Theta Tau, as well as the American Foundry Society.

Heatbath Appoints Wheeler

Heatbath Corporation announces the appointment of *James B. Wheeler* as technical representative for the Northern Ohio area.

Mr. Wheeler has been closely associated with heat treating and metal finishing for the last ten years, first as superintendent of Elyria Plating Co. and later as service representative for General Supply Co. in Cleveland.

Mr. Wheeler will work out of the office and warehouse at 3540 Croton Ave., Cleveland 15, Ohio, telephone Henderson 1-4900.

Haveg Expands into Polyester Fabrication

Haveg Industries, Inc., announces the acquisition of facilities at West Warren, Mass. for the manufacture of polyester fiber glass equipment for chemical and corrosion resistant services. This represents a diversification and expansion for the firm, which has had many years experience in the fabrication of phenolic and furan resins.

Polyester fabrication operations in West Warren will be conducted by the Pla-Tank Division, which will manufacture reinforced plastic equipment and tanks for applications where corrosion resistance and weight savings are a factor.

The *Chemical Corporation* has been appointed a distributor in the New England and Eastern New York State areas.

Charles Bueltman Promoted by Permutit

The Permutit Company, New York 36, N. Y., has announced the promotion of *Charles Bueltman* to the position of manager, Industrial Waste Treatment Department.

Upon graduation in 1948 from Rensselaer Polytechnic Institute where he received a B.S. and B.C.E., Mr. Bueltman joined the firm's sales department. Prior to graduation, he served two years in the United States Navy and earned his commission in the

Charles Bueltman

U.S. Marine Corps in 1947 as a Second Lieutenant. He participated with the U.S. Olympic Team in England during the summer of 1948. In 1950, he was recalled to active duty with the Marine Corps and served as a First Lieutenant in Korea.

When he returned to the company in 1952, his efforts were directed toward treatment of metal finishing solutions and other industrial wastes. Being a member of the A.E.S., he is well equipped to manage this department which is geared to handle problems dealing with industrial waste.

New Central Sales Manager at Park Chemical

Charles R. Foreman is the new general sales manager of the *Park Chemical Co.*, Detroit, Mich., according to a recent announcement.

Mr. Foreman, formerly sales manager of the Metallurgical Products Division of the company, has been with Park for the past 13 years, and in the sales department for past 7 years.

Duff Appointed at Graver

Graver Water Conditioning Co. has announced the appointment of *Joseph H. Duff* as assistant technical manager.

Mr. Duff, a graduate chemical engineer from Newark College of Engineering, has been with the firm's Technical Department for the past seven years. During that time he participated in the development of many products in the industrial and municipal water treatment and industrial waste treatment fields. Mr. Duff, who has wide experience in both the practical and theoretical phases of these fields, is the co-author of several papers presented before leading technical societies.

Joseph H. Duff

Parker Rust Proof Promotes Dowsley

G. W. Dowsley has been promoted to assistant region manager of the South-Central District of *Parker Rust Proof Company*. Manager of the dis-

G. W. Dowsley

trict, with offices in Cleveland, is *B. L. Dittmore.*

Mr. Dowsley has been with the company since 1950, when he graduated from University of Detroit with a B.S. degree in Chemical Engineering. He was assigned to the Technical Service Section, then transferred to the Sales-Service Department. He has serviced accounts in the Grand Rapids, Mich. area and was then assigned to the Columbus an Cleveland areas.

J. E. Haflinger has joined the staff of the Cleveland office and is stationed in the territory formerly served by Dowsley.

Lyons and Wolf Named H-VW-M Midwest Sales Representatives

Hanson-Van Winkle-Munning Co. announced the appointment of *Gordon R. Lyons* as conveyor sales engineer for the midwest sales area. *Richard H. Wolf* replaces Mr. Lyons as salesman in the Dayton area. Both appointments are effective March 1, 1956.

Mr. Lyons has been with the company since June 1949, serving as salesman for the Dayton area until his current appointment. During this period he gained much experience in the engineering and promotion of the firm's equipment, particularly full-automatic conveyors.

He is a graduate of Case Institute of Technology in Cleveland, receiving his BSME degree in 1949. During World War II Mr. Lyons was a Lieutenant in the Army Air Corps from 1943 to 1945. During this period he

Gordon R. Lyons

was a navigator in the 8th Air Force and completed 34 combat missions.

Richard Wolf just completed a six-months' training course in the company's laboratory and other departments at the Matawan plant. During this period he also undertook graduate work in chemistry at Rutgers University.

He was graduated from Lehigh University in 1954 with a BS degree.

Richard H. Wolf

Mr. Wolf's military service includes a year with the Army's Counter Intelligence Corps as special agent and investigator.

Swift Appoints Representative

The Swift Industrial Chem. Co., Canton, Conn. manufacturer of electroplating and metal treating compounds and equipment, announces the appointment of *Acme Engineered Products Corp.* as its representative in eastern Pennsylvania, southern New Jersey and Delaware.

Promotions at Diamond Alkali

Two important promotions have been announced to newly-created positions in *Diamond Alkali Co.'s* recently formed Soda Products Division.

Arthur T. Bennett, superintendent of the former Alkali Division since last August, takes over a similar post in the Soda Products Division, whose production facilities are located at the company's Painesville Works, world's largest integrated alkali-manufacturing plant.

Robert A. Springer, manager of research and Alkali Division for the past two and a half years, becomes manager of research, development and technical service for the Soda Products Division. He will continue to maintain his headquarters at the firm's Research Center.

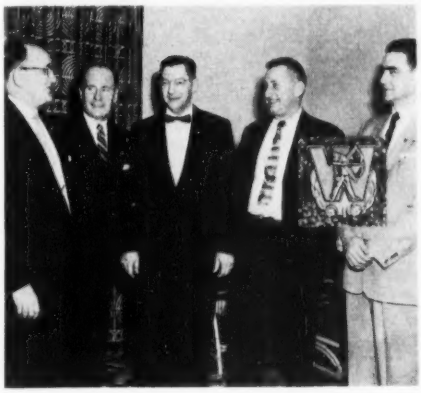
Chicago Office Opened by Metal Finishing

Finishing Publications, Inc., publishers of METAL FINISHING and ORGANIC FINISHING, announce the opening of an office at 35 East Wacker Drive, Chicago 1, Illinois, which will be in the charge of Mrs. Joan T. Wiarda, secretary of the firm and sales manager of the publications. The telephone number is FInancial 6-1865. Copies of both magazines and our GUIDEBOOKS will be available, news items accepted and classified advertising orders taken.

Joan T. Wiarda

Two Well Known Wyandotte Representatives Receive Service Buttons

Shown left to right are *P. N. Burkard*, manager, *Wyandotte Chemicals* Industrial, Railroad and Aircraft Dept.; *A. J. Bettleheim*, district sales manager, New York City; *Emil Haas*, New York, who received a 25 year, 1 diamond service button; *George Haas*, Boston and *James Hubbard*, district sales manager, Boston. The Haas brothers are well known in the metal finishing industry and have devoted nearly 35 years to servicing company customers.



All representatives with the company more than 5 years are now wearing service buttons which were presented during the recent regional sales meetings. Various color combinations plus diamonds indicate years of service. Messrs. Burkard, Bettleheim and Hubbard shown above have service totaling over 40 years.

Tranter Platecoil Appoints New Chicago District Representative

Meters and Controls, Inc., of Chicago, Ill., has been appointed a district representative for the Platecoil Division of *Tranter Manufacturing, Inc.*, of Lansing, Mich. Organized in 1920 by the late *J. W. Murphy*, the Chicago firm has functioned as Meters and Controls, Inc., since 1942, when it was reorganized by *T. G. Robinson*, who is president. The company operates in the northern half of Illinois, the Lake counties of Indiana and the River counties of Iowa. A branch office in Clinton, Iowa, serves the Iowa counties and southwestern Illinois.

Robinson is a graduate of the Lewis Institute of Technology of Chicago, is a registered professional engineer in Illinois and is a member of the Western Society of Engineers and Xi Sigma Kappa engineering fraternity.

Before joining the Murphy organization in 1933, he was with the plant engineering department of Western Electric Co. and for 7½ years was associated with Sargent & Lundy, Chicago consulting engineers.

The organization is composed of 15 people, providing sales service for several engineering specialties manufacturers.

T. G. Robinson

Goodwin to Represent Pennsalt Metal Processing Line in Chicago

Ralph Goodwin

Ralph Goodwin, sales representative for the *Pennsylvania Salt Mfg. Co.'s* Metal Processing Department in Peoria, Ill. and Indianapolis, Ind., has been assigned to serve additional accounts in Chicago.

Mr. Goodwin has been associated with the company since 1951, specializing in sales of the Metal Processing Department's maintenance cleaners for railroads. He lives at 1018 North Ridgeway Ave., Chicago.

Consolidated Brass Moves

The *Consolidated Brass Co.*, after 55 years in Detroit, Mich., has moved to Charlotte, N. C. They are occupying a modern one story plant at 2019 North Tryon St. New modern machinery has been added, enabling them to operate more efficiently and maintain the high standards in quality that has been synonymous with their products over these many years.

They will continue their present complete line of boiler trimmings such as water gauges; pop safety valves; compression gauge cocks; etc., and also rough brass plumbing goods; ground key cocks for air, gas, gasoline, steam, and water; tube fittings; oil and grease cups; and their many special items made to customers blue prints.

American Institute of Management gives Award of Excellence to Diversey

After a thorough analysis of corporate operation, the *American Institute of Management* has awarded *The Diversey Corporation* an award for excellent management.

Lewis Shere, President of The Diversey Corporation, receives his company's award for excellent management for 1955 from Jackson Martindell, President of the American Institute of Management.

The formal report, issued by the Institute, notes the company's rise to a position of major importance in the manufacturing of sanitation chemicals for use in food processing, food serving and metal processing industries. This report also touches on some of the major reasons for this leadership.

OBITUARIES

ALVIN SMITH

On Monday, February 27, 1956, *Alvin Smith*, sales manager of *Imperial Rack Co., Inc.*, Flint, Mich., died suddenly of a heart attack.

Mr. Smith was 57 years old and a well known personality in the plating and finishing field. He had been employed by the company for over five years, and headed their plating-rack and fixture sales.

Mr. Smith was also an active member of the American Electroplaters' Society.

DR. RICHARD M. WICK

Dr. Richard M. Wick, assistant division head, Research Department, *Bethlehem Steel Co.*, died in Baltimore, Md., February 18.

Dr. Wick was born in Topeka, Kan., April 2, 1903. He graduated from Massachusetts Institute of Technology with a B.S. degree in 1925, and an M.S. the following year. In 1932 he received a Ph.D. degree from Johns Hopkins University. After working for the U. S. Bureau of Standards in Washington and Philadelphia, he came to Bethlehem in 1938. Here his entire time was given to the study and development of metallic coatings on steel.

Among his affiliations were the American Chemical Society; National Society of Corrosion Engineers; American Electroplaters Society, where he served as chairman of the research committee in 1948-49; American Institute of Chemical Engineers, and the Engineers Club of Lehigh Valley. He was a registered professional engineer in the Commonwealth of Pennsylvania.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

New York Branch

January 27th was "Nickel Night" in New York. The technical program opened with the showing of a new 45 minute color and sound movie on "Mining for Nickel." The film showed how future mines are discovered by exploration teams and how mapping of the ore body is done. The rest of the film then described in detail how underground and open cut mining is carried out in Canada. The film closed with a cartoon showing a revolutionary new way of extracting low grade ore from previously played out open cut mines.

The meeting was called to order by *A. Fusco,* president.

The minutes of the last meeting were read and approved.

The roll of officers were called and *F. MacStoker* was noted absent. There being no other business to be acted on, Mr. Fusco turned the chair over to *Dr. E. Saubestre,* librarian, who in turn presented the first speaker for the evening *Walter Prine* of International Nickel. He discussed "The Nickel Situation in 1956." By means of slides, he presented many charts showing nickel consumption by various industries in the past few years, and projected this information through 1956 and early 1957. Present allocation policies were reviewed, with particular reference to how the cutback in the automotive industry in 1956 affect supplies of nickel for the electroplater. The question of premium nickel was discussed at length and a historical review was made of how such foreign nickel is priced and what its outlook is for 1956-7. The purpose and effect of heavy diversions from stockpile in 1956 was also mentioned. There was a lively discussion period after the talk, particularly concerning allocation policies between various nickel consuming industries and use of premium nickel.

The final speaker of the evening was *Dr. Clarence Sample* of International Nickel who rounded out "Nickel Night" by speaking on "ASTM Activities in Corrosion of CU-Ni-Cr." He discussed at length ASTM's exposure program at Kure Beach on the copper-nickel- chrome system. Exposures of over three years duration have shed light on the effects of total plate thickness, relative thickness of copper vs. nickel, buffing, and use of a copper strike. One of the outstanding conclusions of this study was that very superior results could be obtained by plating half the desired nickel thickness from a Watts bath, buffing, heat treating, then plating the remaining half of the total nickel coat. Another important conclusion was that for a given thickness of Cu plus Ni, increasing the relative amount of copper was very deleterious. A good discussion period followed in which questions were asked concerning automotive applications, bright nickel, bronze vs. copper, and Battelle's new copper-tin process. The meeting was adjourned with a rising vote of thanks for both speakers by the 65 members and guests present.

Lester Levinson

The Committee for the New York Branch is to be congratulated for a very successful Educational Session and Banquet held on February 11, 1956 at the Sheraton-Astor Hotel in New York City. The banquet was followed by several Broadway acts and an evening of dancing, with over 400 persons in attendance. Part of the gathering can be seen in the above photograph.

Newark Branch

The February meeting of the Newark Branch was held on the 17th with President *Austin* presiding. Four new members, *Warren Wilkinson* of Hanson - Van Winkle - Munning, *Murray Ross* of Bell Laboratories, *Anthony Richards* of Jersey Plating Co. and *Francis Klemm* of Kelite Corp., were elected to membership and four applications were accepted. Secretary *Foulke* read a number of communications including one from the Newark Chapter of the Red Cross for which a $25 contribution was voted.

Cliff Struyk reported on the Technical Societies' Council program for March 29th on "Plant Rehabilitation" with *Val Peterson* as main speaker. *Dodd Carr* reported the second elec-

troplating school will begin in February with much interest in this a repeat course.

Frank England reported for the nominating committee (*R. Ehrhardt*, chairman, and *Howard Cobb*) as follows: President, *Clifford Struyk;* 1st Vice-President, *William Grigat;* 2nd Vice-President, *Gustave Bittrich;* Secretary, *Don Foulke;* Treasurer, *George Wagner;* Librarian, *Dodd Carr* and Sergeant-at-arms, *Fred Meyer.*

The meeting was then turned over to Librarian *Gustave Bittrich* who introduced the speakers of the evening.

Al Korbelak chose as his Timely Topic: "Plated Wiring." He brought out rather strongly two points, namely —that the use of good board quality is a very desirable factor, and the use of silver on these circuits should be avoided because of silver migration.

Edward C. Bertucio of Mutual Chemical Division of Allied Chemical & Dye Corp., spoke on "Some Interesting Applications of Chromium Plating." He pointed out that chromium finds much use in industry because of its hardness, low coefficient of fraction, and resistance to corrosion. He then described the application of chromium to diesel cylinder liners illustrating two processes, grit blasting prior to chromium plating and chromium plating followed by a pin point and channel type etching procedure. Both processes provide some space in the chromium plate for the lubricant. He claims that the chromium plating of the liners increases the service life by 60-90%.

He also spoke on the plating of printing rolls and gun barrels. These are massive pieces and they require some unusual procedures. The life of printing rolls was increased to as high as 2½ million impressions. The increase in the service life of the gum barrels was purposely omitted.

Lantern slides and Kodachromes were very interesting and completely rounded out the lecture.

Dr. Gardner Foulke
Secretary

Detroit Branch

The February meeting of the Detroit Branch was held in the Michigan Room of the Statler Hotel on February 3, 1956.

A very interesting movie, "The Man with the Thousand Hands," sponsored by the International Harvester Co. started the meeting at 8:00 P.M. This is a colored film of the story of the Kinamett Aluminum project in Canada.

President *Lee Morse* officially opened the meeting at 9:05 P.M.

Joe Guoski, Nominating Committee chairman, submitted the following nominations for officers for the 1956-57 Society Year:

President—*Howard McAleer.*

1st Vice-President—*Bob Racine.*

2nd Vice-President — *Glenn Friedt, Jr.*

Secretary-Treasurer—*Ed Kubis.*

Educational Chairman — *Doug Thomas.*

Board of Managers — *Guy Cummings, Jr.*

C. D. Sparling was given credit for the fifth new sustaining member of the year, Alco Chemical Co. Mr. Morse announced that the next month's meeting will be ladies' night. Mr. Guoski will speak on his recent trip to Europe.

Mr. Friedt, technical chairman of the evening, introduced the speaker of the evening, *Howard McAleer* of Formax Mfg. Co. The title of his talk

was "Polishing and Buffing Materials and their Application." Howard gave a very interesting talk in which he used slides taken on his Mexican vacation showing the Sisal Industry.

Patrick J. Driscoll

Milwaukee Branch

"*Plating for Precision, Perfection and Profit*" is the theme for the annual party of the *Milwaukee Branch*, to be held April 28, 1956 at the Schroeder Hotel. The technical session will be held from 9:30 A.M. to 12:30 P.M., followed by cocktails from 12:30 P.M. to 1:30 P.M. and a luncheon from 1:30 P.M. to 3:00 P.M. The banquet and entertainment are scheduled for 7:00 P.M. There will be no afternoon sessions.

Speakers at the technical session will be *Clarence H. Sample* of International Nickel, who will speak on "History and Importance of Specifications in Electroplating"; *Dr. R. B. Saltonstall* of the Udylite Corp., speaking on "Producing and Testing Specification Plating"; and *Lloyd O. Gilbert* of the Rock Island Arsenal, whose talk will be, "Some Experiences of Government Agencies in Purchasing Specification Plating. Case Histories, Troubles and Solutions." *Clyde Kelly*, National President, will give a short report on the activities of the Society during the luncheon.

Requests for reservations should be made to *Robert Steuernagel* or *Fred Anderson*, at 2370 N. 32nd St., Milwaukee 10, Wis.

Baltimore-Washington Branch

The February meeting of the Baltimore-Washington Branch was held in the Chemistry Lecture Room in the Chemistry Building at the National Bureau of Standards. The only order of business was the election of *Milton H. Newman* to membership.

The educational session consisted of two movies. The first, "Mining for Nickel," was a forty-five minute sound and color film sponsored by The International Nickel Company, Inc.

During the intermission following the showing of this film, the branch was served refreshments consisting of some very tasty sandwiches, coffee and "cokes." Credit for this treat is due *Dr. Wood* and her committee.

The second movie, "Science of Making Brass," was a twenty-nine minute sound and color film depicting the manufacturing processes involved in making the various brass items produced by the Chase Brass and Copper Co.

Carl H. Thiede
Secretary

Chicago Branch

On February 10, 1956, an interested and enthusiastic group of members and guests attended the monthly meeting of Chicago Branch, held at the Western Society of Engineers Club. In line with their program of broadened coverage and intelligent inquiry into modern methods, materials and finishes, the speaker of the evening was *Russell V. Vanden Berg*, manager of the Finishes Section-Process Development Laboratories of Aluminum Co. of America. Mr. Vanden Berg discussed both electroplated and anodic finishes on aluminum.

Devoting the first portion of his talk to electroplating on aluminum, he pointed out the many advantages and drawbacks of electrodeposited coatings on aluminum, calling special attention to the fact that, though there are many

good reasons for plating on aluminum, one should never plate on aluminum for corrosion protection. Following these words of caution, he discussed the historical background and the current practice of plating on aluminum. The portion covering anodic coatings was well illustrated by the showing of an excellent set of slides accompanied by appropriate remarks.

Unquestionably the good attention and the large number of questions asked of Mr. Vanden Berg is a good indication of the interest in the subject and the high quality of the speaker.

Preceding the technical portion of the meeting, officers and members, in a business session, gave special attention to the ladies in planning and anticipation of the Annual Ladies Night Meeting in April. From the discussion it appears that everyone will look forward to a *Big Night*.

Members heard with regret of the passing of *Bill Varnish*, an active and long time member of Chicago Branch.

Members of the February panel of experts were:

Ed Smith, George A. Stutz Mfg. Co., on plating equipment.

Bob Scheel, Heil Process Equip. Corp., on corrosion resistant equipment.

Joseph Corre, American Phenolic Corp., on coloring anodic coatings.

Jerome Kuderna
Publicity Chairman

Pittsburgh Branch

The March meeting of the Pittsburgh Branch was highlighted by the election of officers for next year. They are President, *Myron Ceresa;* 1st V.-P., *Herb Schram;* 2nd V.-P., *Jim Crain;* Secretary, *Fred Stevens;* Treasurer, *Bill Pizoli;* and Librarian, *Russ Reynolds*. To the Board of Managers, *Rudy Schindler* and *Rex Goldbach*. Elected to represent Pittsburgh as delegates were *Rudy Schindler, Bob Woofter* and *Ed Smith*, and as alternate delegates, *Myron Ceresa, Rex Goldbach* and *Leo Schmitt, Sr.*

Other business which took place was the introduction to the members of three new applicants to the Society, *W. Scott McCormick, A. J. Chinnici* and *C. R. Harr*. The business session was concluded with a report by *Ken Hittle* that plans were all set for the Ladies' Night Banquet April 21st.

The evening, which had started with dinner at the Avalon Room of the Sherwyn Hotel, was concluded with an excellent talk by *R. E. Hafer* of Reynolds Metal Co., who discussed "Chromic Acid and Sulfuric Acid Anodizing Processes." Dick's very enlightening talk was highlighted by some practical tips for economy and improving quality.

The meeting was concluded with the drawing for the door prize and question session after a short refreshment break. *Joe Bugel* won the prize presented by *L. M. Ring* of Ring Supply Co., a Ladies Sunbeam Electric razor.

Herb Schram
Secretary

AMERICAN ZINC INSTITUTE

The American Zinc Institute has announced that its 38th Annual Meeting will be held at the Hotel Statler, St. Louis, Mo., on Monday and Tuesday, April 23 and 24.

News from California

By Fred A. Herr

The William R. Whittaker Co., manufacturer of aircraft valves, has acquired the former Grayson Controls Co. plant at 3000 Imperial Highway, Lynwood, Calif., and is in process of installing a plating division of 6,000 square feet area equipped with approximately $100,000 worth of plating, anodizing, and polishing equipment.

Production, engineering and administration facilities are being moved from 1915 East 51st St., Vernon, Calif., to the Lynwood plant which will be known as the manufacturing division. Company officials expect to have all activities, except the personnel and sales division, which will be retained at 910 N. Citrus Ave., Hollywood, installed at Lynwood by May 1.

The plating department is being equipped with facilities for plating cadmium, special blackening, conventional andozing, nickel, and hard anodizing facilities. Among major items of equipment being installed in the plating division are two 500-gallon hard anodizing tanks, two 500-gallon sulphuric acid anodizing tanks, three 400-gallon chromic acid tanks, and a separate buffing department with five polishing lathes.

The Whittaker Co. is the largest manufacturer of hydraulic and sleeve valves on the West Coast and the Lynwood facilities are being geared exclusively for manufacturing and finishing valves and valve parts. *Martin Barsoom* is superintendent of all metal finishing, welding, painting, and deburring.

George W. Slomin, who heads George W. Slomin & Associates, an experimental electrochemical laboratory organization in Los Angeles, reports he has moved facilities from 925 North Western Ave. to larger and more commodious quarters at 319 West Pico Blvd.

The new quarters provide Mr. Slomin and his associates with quadruple the space that was available in the former building. In addition to electrochemical engineering services, Slomin announced, the firm now has manufacturing facilities for the production of special types of plating equipment. Facilities have also been installed for the electrodeposition of precious metals in the platinum group, and gold, silver, and indium. Moving at an accelerated pace in the new plant, according to Slomin, is the production of a ready-mix plating solution for use with rhodium, ruthenium, platinum, indium, etc.

Slomin disclosed he will offer an instructive course in special electrochemistry and plating problems geared to the level of technicians, laboratory personnel, and chemists who desire to broaden their knowledge in fields beyond the realm of conventional plating. Classes will start about June 15. Both the lecture type and actual demonstration techniques of teaching will

be used. Slomin, a registered professional engineer, and *Dan Schneiderman* of the California Institute of Technology, will be the instructors.

Jack W. Schultz reports that he has opened new headquarters for his organization, Jack W. Schultz & Associates, at 7550 Melrose Ave., Los Angeles. The new facilities make available 4300 square feet of warehousing and production area for Jack's activities involving the manufacture of electroplating chemicals and distribution of plating shop equipment and supplies.

Electrical engineering as it effects the operations of the plating and polishing phases of the metal finishing industry will play a prominent role in the displays of the Eighth Biennial Electrical Show scheduled to be held April 5 to 7 at Shrine Auditorium, Los Angeles, under the auspices of the Electrical Maintenance Engineers Association of Southern Calif.

Harry G. Brustlin has been promoted from the post of abrasive engineer for the Norton Co. in the Los Angeles area to west coast district manager, with headquarters in Los Angeles. He succeeded *Robert Cushman* who has returned to the main office in Worcester, Mass., as assistant to the sales manager of the grinding wheels division.

A & A Die Casting Co. in February moved into a new $250,000 plant of 26,000 square feet floor area at 12901 S. Western Ave., Los Angeles. The company was founded in a garage in West Los Angeles 10 years ago by *Victor O. Anderson* and *John A. Allen*. Some $100,000 worth of additional equipment has been installed in the new plant. The firm is one of the supporters of the Certified Zinc Alloy Plan for die castings, a licensed certification program to permit customers to identify quality of die castings which bear the CZ mark.

Price-Pfister Brass Mfg. Co. of Los Angeles has announced acquisition of certain assets and the major part of the equipment of Detroit Brass Valve Division. The West Coast firm also acquired patterns from the Detroit firm for gate, globe, check and angle valves, gas service cocks and standard stops.

Price-Pfister, which operates one of the largest company-owned plating plants in Southern California, is now reportedly the only firm in the West which manufactures a complete line of gate, valve and globe valves in addition to an extensive line of regular plumbing brass goods.

Fairchild Camera & Instrument Corp. of Syosset, N. Y. recently opened its first west coast branch at 6111 East Washington Blvd., Los Angeles, for the manufacture of potentiometers. It is known as the Potentiometer Division of Fairchild Camera Corp., a wholly owned subsidiary of FCI.

Los Angeles Chemical Co. has announced the start of construction on a new $300,000 plant on an 8½ acre site in South Gate, Calif., into which the facilities of the firm will be moved from 1960 Santa Fe Ave., Los Angeles, in the fall. The new factory will comprise 45,000 square feet of floor area equipped for the manufacture of insecticides, fungicides, reagents, plating chemicals and scientific instruments.

Stanley W. Hishon, formerly plating superintendent for the 57-year-old Montreal, Canada, job shop firm, John H. Feeley & Sons, has moved to Southern California and has joined the finishing staff of *Bernie Gardis'* Plating, Inc., in Glendale, Calif.

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